The Chemical Age

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Notes and Comments

The Autumn Outlook

THE industrial outlook to-day is very different from that which prompted us exactly a year ago to devote a whole leading article to the critical position which had just been created by the abandonment of the gold standard, the raising of the Bank Rate to 6 per cent. and the closing of the Stock Exchange. Credit has been restored by the work of the National Government, and the confidence which other countries now have in Great Britain is one of the factors which will hasten the world trade revival. The steady improvement which has been recorded in the chemical industry since the beginning of the present year is of greater importance than appears at first sight. The chemical industry does not sell its goods to the public generally, but is a supplier of other industries which only purchase more chemicals when they are themselves expanding. The purchase of raw materials is sometimes removed some distance from the supply of the finished article, and people start to purchase chemicals when there is a demand for their manufactured articles. That has been going on for some time now, and it appears to be a good barometer of trade generally.

Though we are not yet out of the wood, we are getting through it, and a perusal of the expressions of opinion of some of the leading men in the chemical and allied industries which are printed in other pages of this issue canot fail to create an impression of restrained optimism as to the future of those industries. Some time ago there seemed to be an impression that it was possible for the British Empire to be self-supporting and prosperous regardless of the rest of the world, but it is now generally acknowledged that while it is possible to improve our relations within the Empire and to increase our Empire trade, we must at the same time make sure to get world trade as well.

Planning for the Future

FROM a number of inquiries which have reached us recently on the question of factory development and new processes of production, there would appear to be evidence, if not of an imminent boom in trade, at any rate of a more promising outlook on the part of the chemical industry as it approaches the winter months. It is opportune, therefore, that attention should be drawn in this Autumn Annual Number to the lines along which chemical maufacturers may look for a solution of some of their works problems. We are not so optimistic as to imagine that more than a small percentage of firms are contemplating laying down entirely new works in the immediate future, but we are strongly of the opinion that every firm must be prepared for the turn of the industrial tide and must either bring its existing works up to date or construct new ones if it is to hold its own in the future development of chemical manufacture and production. One has only to take a cursory glance at many of the smaller chemical facttories of this country to recognise that among the less prominent undertakings there are many endeavouring, with commendable enterprise, to solve problems which are too big for them in their present restricted circumstances. The nature and extent of their operations were unforeseen when they were first established. They have grown, with the steady increase in the demand for their products, on somewhat haphazard lines, without regard to such important considerations as economical handling, power supply and general perspective, with the result that they are unnecessarily expensive to run and not sufficiently well organised to meet modern requirements.

It may be that entire reconstruction is out of the question at the present juncture, but there is much that might be done to make them more efficient. In other industries, where production problems are common to every unit, varying only in intensity in proportion to the volume of the commodity produced, there are central advisory organisations to which the smaller undertakings may apply for technical advice, but in the making of chemicals no two concerns share precisely the same difficulties, and the exclusive nature of each manufacturing process renders it extremely difficult for one section of the industry to seek or receive from another section the assistance necessary to rationalise the process concerned.

The Problem of the Smaller Works

IT is to the smaller chemical works that the industry must look for the modernisation necessary to convert the more favourable prospects of the future into realisation. The larger works are already adequately equipped and capably staffed, but the smaller ones must be brought up to date if they are to avoid absorption or bankruptcy. In other pages Mr. J. H. West, who is experienced in dealing with the adaptation of old works to modern needs and the design of new factories, outlines many of the factors which must be considered in planning a new factory. He rightly points to such simple but often overlooked precautions as the preliminary laying of pipe lines and the desirability of having all the heavy machinery delivered before the builders have removed their lifting tackle, and many other aspects which make for smoothness and efficiency. He concludes with a plea for the use of everything British. There is no necessity to stress this point, for British manufacturers have been laying themselves out for some time to provide everything that is

required, and sheer economic necessity nowadays favours a "Buy British" policy. At the same time many of our chemical manufacturers depend for a substantial part of their income upon a sound export trade, and will do well not to shut the door entirely against the assistance of their overseas friends. In short, the chemical manufacturer must equip himself with the most efficient facilities he can find for the rebuilding of his depressed industry. It is up to the builder, the engineer and the plant maker to see that British materials are best, and then they will have no fear that the chemical manufacturer will go outside the country for his requirements.

In recent months THE CHEMICAL AGE has been the medium through which manufacturers confronted with new problems of works design and processes have been brought into touch with experts able and willing to put them on the right lines towards a solution, and we venture to hope that we may be the means of further assistance in this direction, for we believe that it is only when the small manufactureer has has the courage and the candour to confess that "two heads are better than one" that the industry will be able to make the fullest use of the expert knowledge that is available.

The Handicap of Dearer Dyestuffs

A TIMELY recital of the difficulties which beset the cotton industry of this country was delivered by Mr. Lennox B. Lee, the chairman, at the annual meeting of the Calico Printers' Association at Manchester last week, when he reviewed the new fiscal policy, the heavy burden of taxation, the Ottawa conference, the position of dyestuff makers and colour users and the need for re-organisation of the cotton trade. Since tariffs became a dominant issue, Mr. Lee has urged that the export trades, and particularly that of cotton, should be treated with the greatest care. The industry, which to-day employs an average of 700,000 insured workers and has an average annual turnover of £150,000,000, is exposed in every market to the cold blast of foreign competition, aided by cheap labour and low taxation. Mr. Lee pointed out that one of the best examples of the handicaps placed upon the cotton trade and of the unequal burden imposed by a protective in addition to a tariff system was afforded by the position of the colour makers. Despite a definite promise made by the Government that prices should be world prices, and the considerable financial sacrifice which the finishing branches of the cotton industry had been called upon to make for twelve years—two years longer than the makers themselves had considered necessary—in order to build up a British dyeware industry, prices had lately been raised on an average by 25 per cent., at a time when strenuous efforts were being made to reduce production costs in order to help in the recovery of Great Britain's lost export trade. It is, he said, a mistaken policy to exploit an industry at any time, but in times of national emergency it is inexcusable, and no-one appreciated that more than Sir Harry McGowan, the present chairman of Imperial Chemical Industries, Ltd., who stated in October, 1927, that his combine was not formed with the idea of raising prices or of creating monopolies, but quite the reverse, and that increased profits were looked for rather as a result of greater efficiency.

The President of the Board of Trade on November 19, 1930, was emphatic that users should be able to purchase their colours at world prices, and further, when supporting the continuation of the Dyestuffs Act, asked "Is it not a fact that makers of dye in this country are prepared to give an undertaking that if the Act is continued there shall be free entry of any dye which cannot be manufactured in this country?" Mr. Lee said there could scarcely be but one implication in that question. The present Parliamentary Secretary also said in the House of Commons on November 13, 1931, that the makers in this country were charging competitive prices and that in no case were those prices greater than the world prices for the same commodity. In view of what has happened it is impossible to reconcile these utterances with the facts. How are world prices to be secured when, as a result of agreements entered into by British makers with their foreign competitors, the latter are debarred from quoting for home requirements?

A comparison of British and foreign pre-war and 1932 dyestuffs prices will perhaps best illustrate the position. In the British list the increases range from 31 per cent. to 245 per cent.; in the foreign list the highest increase is 194 per cent. Even comparing the 1932 with the 1931 prices, increases in this country's list range from 10 per cent. to 91 per cent., representing an extra cost to the Calico Printers' Association alone of £90,000 per annum. It is, to Mr. Lee's mind, inconceivable that Parliament ever intended that under a Prohibition Act a cartel should be arranged with foreign makers to prevent the ruling of world prices by legitimate competition and so render the pledges given by the Government incapable of fulfilment.

The Ottawa Conference

REFERRING to the Ottawa Conference, Mr. Lee said that although it is perhaps too early to form a definite opinion as to the ultimate result of these negotiations it seems clear that so far as a general lowering of tariffs and freer trade are concerned we are no nearer our objective. On the contrary, in return for vague and somewhat indefinite undertakings on the part of the Dominions, our negotiators have committed us for at least five years to a policy of preferential tariffs covering a wide range of commodities, and restraint is to be placed upon our trade with the rest of the world, the effect of which must be ultimately to increase our costs of production. It must not be forgotten that during the last 3½ years the value of the exports of cotton piece goods to foreign countries was £113,000,000 and to the British Empire £107,000,000.

One of the causes of our industrial troubles is that in addition to foreign countries shutting us out of their markets the Dominions have also adopted a similar policy, and in return for a relatively small addition to their purchases from us they have sought by means of preferential tariffs or quotas to hold and increase that advantage. If the development and extension of our trade depend upon reciprocal tariff agreements, then, in considering the needs of the Empire, our relationship to the world as a whole must not be overlooked. Unless, therefore, the decisions of the Conference at Ottawa are interpreted in this spirit Mr. Lee is of the opinion that there is the danger that serious injury will be done to our world export trade.

Planning a New Chemical Factory

By J. H. WEST, M.I.Chem.E.

WHILE the chemical trade, in common with industry generally, is still suffering from intense depression, signs are not lacking that under the surface a good deal of quiet preparation is going on ready for a move forward when the long hoped-for trade revival comes. It may therefore be useful to consider the problems involved in planning a new chemical factory, and to discuss the best way of tackling these problems systematically.

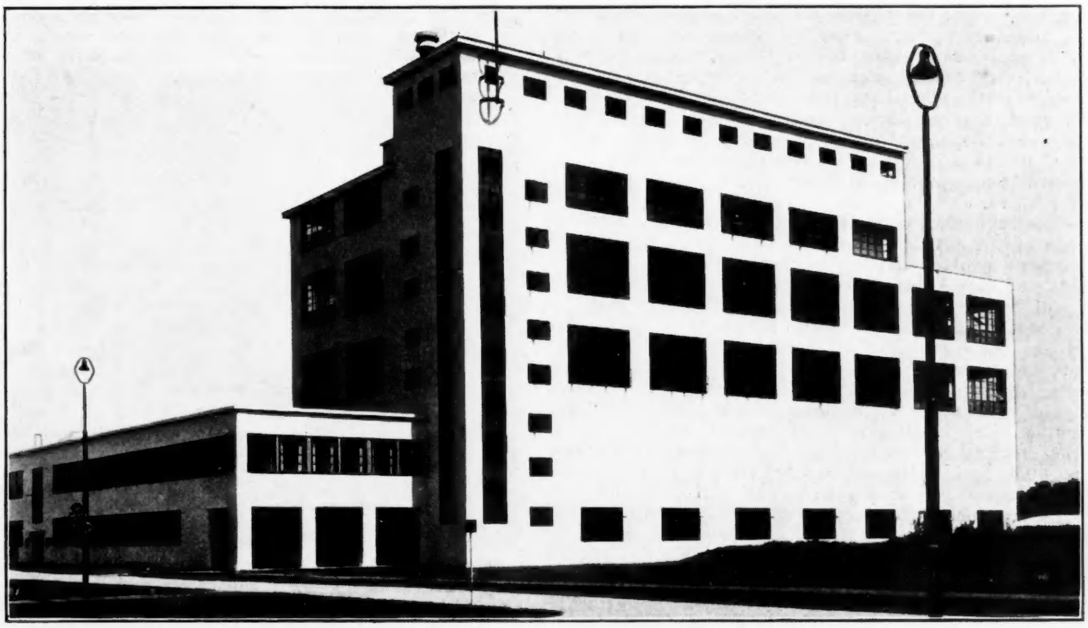
Many factors may influence the choice of a site, but there is often one requirement in connection with the particular manufacture under consideration which will limit the choice to a few districts where alone that requirement can be found. For instance, if the raw materials come from abroad, it will probably be necessary to choose a site in or close to a seaport. Or again, gas heating on a large scale may be required. Then one of the districts such as Sheffield or the Black Country, where a public supply of power gas is available, is indicated, so as to avoid the cost of putting down a gas producer installation. Visualising the problem in general terms so as to get a clear idea of what we have to do and what it is going to cost to do it, we have to acquire a site, to construct upon it the necessary buildings, and to install in these the necessary plant. Besides the actual process plant we have to provide various services, water, steam, power, perhaps gas for heating, lighting, fire protection, office, stores, laboratory and repair shop accomodation, and so on, and also internal transport arrangements within the factory. We have next to engage staff and labour, get the raw materials to the factory, get the manufacture under way, and finally deliver the products.

What are these items going to cost individually per ton of product? In the answer to that question lies the selection of the site. It is assumed, however, that before the planning of the factory is begun, the various processes have been thoroughly worked out, flow-sheets of various kinds have been prepared, the respective lay outs of the plants have been settled, and that full information on all requirements is available to the planning engineer. If this has not been done the answer to the above question will not be forthcoming and the intelligent selection of the best site will not be possible, nor will any scientific planning of the factory.

The first thing to be done is to make a preliminary approximate estimate of capital cost and operating costs, noting particularly the items which may vary considerably with the site, and the relative importance of these, always on a basis of cost per ton of product or products. The allocation of overheads, the rate of interest on capital, and estimated allowance for depreciation and repairs should now be settled. It will then be possible to compare the cost per ton of product for various sites by putting into the estimates the correct figures for each site. Let us take first the costs involved in the site itself. There is first the cost of the land, or its rental. Then the rates, and any payments which may have to be made to local authorities for road access, wharf rights, railway connections, drainage, or bringing town water, gas, or a public electric supply on to the site.

Coming next there is nature of the site itself. How much levelling, involving excavation and filling, will have to be done, and what will this cost? Then the most important question of the subsoil. This may be strong clay capable of standing loads up to 4 or 5 tons per square foot, rock of still greater strength, or on the other hand it may be soft clay, or made up ground where half a ton per square foot is the safe limit, and where piling may have to be resorted to for heavy buildings. In the latter case the cost of the foundations may be three, four or more times as much as in the former. There is further the question of whether a water supply can be obtained by sinking a well on the site, and if so at what depth water is likely to be found, and in what quantity. The aspects of the site from the building point of view must also be considered. Are good bricks obtainable locally, or if they have to be brought from a distance, what will their delivered cost be? What about local supplies of aggregate and sand for concrete, and of hard core for road making and the road bed of sidings? If these materials, of which large quantities may be needed, have to be brought long distances the additional cost may be quite considerable.

Water is always, or almost always, a very important consideration in a chemical factory—water for boiler feed, for use in the processes, for cooling and for drinking. The quantity of boiler make up, after allowing for any condense from power units or closed steam process heating, will be known, and an analysis of the water will show whether



The new British Bemberg factory at Doncaster, a portion of which is illustrated, is a good example of modern works design. The architects were Wallis, Gilbert and Partners, South Kensington.

softening is necessary. It may be necessary to use town water or even condense in the processes if clean pure water is essential. For cooling, sea water may be used, if the factory is close to the sea or an estuary. This usually costs nothing but the cost of pumping, but involves special materials in the coolers to avoid corrosion, and is likely to cause trouble to the pumps from grit, and trouble in the coolers from suspended mud in stormy weather. The maximum summer and minimum winter temperatures of water supplies are important, particularly where low-boiling substances have to be cooled. Sea and river waters will vary most, say from 37° F. to 67° F., while well water may not change more than 10°, say from 47° F. to 57° F. Quantities required must, of course, be reckoned on the maximum temperatures. In hilly districts it may be possible to get a supply from a point well above the factory, and so avoid pumping, or it may be necessary to pump to a considerable height from a low-lying river. Ample pressure must be available to reach the top floor of the highest building.

Steam and Power Requirements

The questions of steam and power are linked together, and in getting out the general scheme for the factory it has probably been decided how they shall be dealt with. In most chemical factories the demand for heating steam is far greater, often eight times, than the steam required to generate the necessary power. In such a case it may pay to put in low or moderate pressure boilers for heating steam only, and take electric current from the public supply for all power purposes. On the other hand power and steam requirements may be more nearly balanced, and steam may be generated at high pressure, put through pass-out, or back-pressure turbines, and then be used for heating, any deficiency from this source being made up by boiler steam passed through a reducing valve.

It is not suggested, of course, that detailed estimates can be made of the cost of all the items referred to, and the many others involved but not mentioned for lack of space, for each individual site. This would obviously be impossible, but an experienced planning engineer can make a pretty good rough guess at them which will be quite near enough for the purpose of comparing different sites. The railway companies and local authorities are now so keen on attracting new factories to their districts that most of them have readily available an immense amount of useful local information, which will save much time in making special inquiries. Prices can then be quickly obtained for suitable coal or other fuel, delivered on site, electric current, town water and town gas if required, and rail rates on raw materials, and on products to their chief centres of distribution. A copy of the local building bye-laws should be obtained, and examined to see whether there are any special restrictions, and the local regulations concerning the disposal of trade effluent should be ascertained. The Labour Exchange should be visited to get information regarding the supply of skilled and unskilled labour, and the local rates of wages.

The question of providing housing acommodaion for staff and workpeople, which in the old days was a serious problem in country districts, may now be said to have disappeared, for the local bus companies will generally run a service from the nearest town to suit the working hours.

The General Lay-Out

Separate scale outline plans of all the buildings should be prepared on thin card and be laid on a large scale plan of the site. These can be moved about and repinned down to compare different arrangements until the best is found. It is not easy to lay down any general principles, since the requirements of different factories and the topography of sites vary so greatly. The run of the railway sidings, where these exist, is one of the first things to settle, for room must be left for easy curves. A radius of 200 feet will take with care any wagon which may have to be dealt with. Except in the case of the smallest sidings with just accommodation for four or five wagons, the single line of entry should split into two, preferably straight and parallel lines as near the point of entry as possible. One of these lines is used to receive incoming trains, and must always be empty at the time of the daily shunt or shunts from the main line. The other is for outgoing wagons, which are left coupled up there so that the railway company's locomotive can push in one lot of wagons and pull out the other without any waste of time. The length of these lines must be sufficient to take the maximum number of wagons which may come in at one time. This will never exceed 40, the number in a full-length goods train. In special cases, such as a beet sugar factory, where the traffic may reach two or three thousand tons net per day inwards, the two lines are expanded to a grid of six or eight lines. Where there is a considerable volume of traffic the usual arrangement of several diverging lines all ending in a dead end is definitely bad, and leads to congestion and delay. They should, where possible, be a ring round the site so that inward wagons can travel one way and outward wagons can use a different line. There will be certain definite points where incoming wagons are unloaded, and others where outgoing wagons are loaded. At these points there should be shunting necks or dead ends where the wagons can stand without obstructing traffic on the main sidings.

Roads should be kept as wide as possible; 24 feet for the main entrance road, and 20 feet for other roads are good figures, and roads and sidings should be kept away from each other as much as possible. Ample room for lorries to turn round should be provided at dead ends. The relative position of the various buildings depends so much upon the particular circumstances of each case that no general rules can be given. The stores and repair shop should be fairly central, and the offices should be near the main entrance so that callers can reach them without going through the factory proper. The process buildings should be arranged so as to facilitate easy transport of intermediate products from one building to the next in an orderly sequence. The spacing of the buildings should be determined by the fire risk. In the case of highly inflammable or explosive products the buildings should be kept well apart, say 50 or 60 feet, or more if the buildings are very high. When the position of buildings, sidings and roads has been settled, the main runs of underground pipes, water, surface and sewage drainage and effluent should be set out on the plan, taking care to keep these clear of areas reserved for extensions.

Provision should be made in the original lay-out for future extensions, both as regards the extension of the plants originally put in, and the later addition of plants for other products. If this is not done in the first place, many of the advantages of a good initial lay-out may be lost in subsequent years. For instance, if a second plant for a particular product is later required, and no room has been left for it in its proper place, it may have to be put down in some inconvenient spot in another part of the site instead of alongside the old plant.

Building Operations

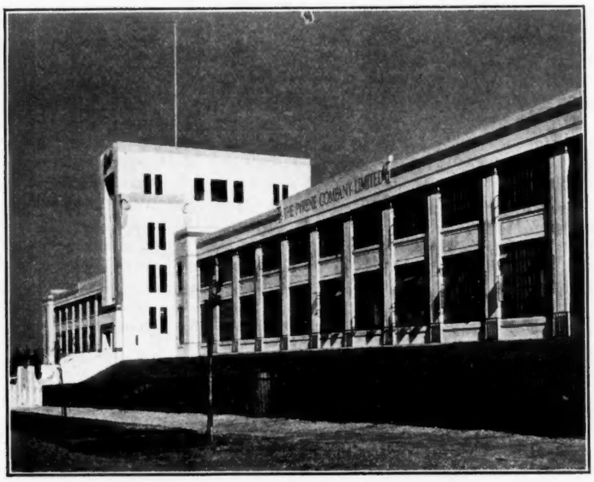
The type of building to be adopted, and the way the contracts are split up, will depend on the particular circumstances of each case. It is usually best, on a fairly large site, to let the excavation, filling, road making, sidings road-bed making and trenching as a separate contract. Concrete foundation and other concrete work may be included in this contract, particularly if steel-framed buildings are adopted, and also any incidental brickwork, if this is not extensive. It is well to invite tenders for this contract on a schedule basis. It is unlikely that all building drawings will be ready in time to get a lump sum quotation, and there are sure to be some alterations and additions. The schedule should cover excavation to various depths, including depositing the excavated material where required for filling, road making, and rail road-bed making to a given specification, filling in the interior of buildings with sand or hard core up to floor level, filling in round the exterior of buildings with excavated material, trenching for pipe lines and electric cables, and if concreting is included, for mass and reinforced concrete foundations, dwarf walls, pits, slabs, floors and so on. The laying of spigot and socket cast iron water mains, and of stoneware drains may be included in this contract, and a schedule for laying various sizes at various depths be obtained.

A specification for the concrete to be used should be prepared, and it is well to take sample cubes from time to time of the actual concrete going into the work and have crushing tests carried out. A sharp eye will have to be kept on the contractor to see that no inferior foreign cement is used,

and that the aggregate and sand are clean and are correct to specification, and that too much water is not used in the mix. For factory roads nothing is better than concrete reinforced with a layer of R.B.C. fabric. Less expensive and quite good roads can be made with a 9 inch bottom of stone pitching, covered with three or four inches of small broken stone or slag well rolled in and covered with a tarmac carpet. As regards the sidings, the railway company will usually lay the track if asked to, but it is cheaper to get some of the contractors who specialise in this class of work to do it. It pays to put down good substantial track so as to avoid frequent derailments and perpetual repairs. Flat bottomed rails spiked on to secondhand sleepers are low in first cost, but very heavy in upkeep. Good secondhand standard 96 lb. or 100 lb. rails laid in new chairs on new creosoted sleepers will last for many years with hardly any attention.

Factors which Influence the Buildings

All-brick buildings are in most cases too expensive, and they take a long time to construct. Steel-framed buildings, covered with sheeting, such as corrugated asbestos, or coated corrugated iron, or filled in with brick or concrete block panels, are very suitable for chemical factories. The question of floors is rather a difficult one, because chemical plant is so often altered. Processes are modified or changed, and the plant with them, and if solid concrete or similar floors are put in this makes plant alterations very difficult and usually involves a lot of cutting away and making good. Wood floors are bad from the fire risk, and they do not stand much wear from trucks running over them. Open steel grid floors of the "Safetread" type have much to recommend them. They can be taken up to get big vessels into position or to take them down for repairs, and they lend themselves perfectly to alterations, for the plant is not carried on the floor, but on trimmer joists between the main floor beams, and these trimmers can be quickly taken down and moved to another position when required. Where heavy plant has to be put in on upper floors an overhead travelling crane should be put in, and either a central well in the middle of the building, or a space at one point should be left free of apparatus on all floors. The plant can then be lifted up in the well or space to the required floor, and the same method can be used for taking it down in case of repairs or alterations. The well or space can be floored over with steel gratings when the building is in use.



The latest developments in works construction are incorporated in the new Pyrene Works at Great West Road, Brentford. Wallis, Gilbert and Partners were the architects.

The question of foundations must be carefully considered when the ground is bad. Tests can easily be made by loading a wooden post from 4 inches to 6 inches square, kept vertical by a framework, until it begins to sink into the ground. About half the load per square foot so found may be used in the foundations. The test should be made at the depth corresponding to the bottom of the foundations. In soft clay the soil dries out and shrinks to a considerable depth, cracks sometimes extending to a depth of 6 feet in a dry summer. Foundations should be carried down below this depth or they cannot be depended upon. Rather better than the old arrangement of a reinforced concrete raft under the whole area of a building is a system of well spread out separate bases for the stanchions and piers to carry heavy plant, each base being designed with a safe area to carry its own load. There is then less risk of settlement than with a raft which is sure to be unsymetrically loaded and may in consequence tilt. There are reinforced concrete specialists who will undertake the design of the foundations upon being supplied with drawings of the buildings, showing both the stanchion loads due to the building itself and those due to the plant, and will also supply the reinforcing bars, ready bent to shape, at a fixed price per ton which includes the cost of making the designs. This is often a very convenient way of dealing with this question.

A practical hint regarding foundation bolts may be given. When long holding down bolts are placed in wooden boxes in the concrete which form the grouting holes there is nearly always difficulty in getting the boxes out of the concrete when it has set, even when the boxes are well tapered and greased. A much better plan is to use two lengths of round bar, hooked at the lower ends and screwed at the top ends where they are passed through holes near the ends of a rectangular plate and nuts put on above the plate. In the centre of the plate is another hole through which the holding-down bolt proper is passed from underneath. The hooked bars can be embedded direct in the concrete up to an inch below the plate, and then a short box, 12 in. or 15 in. deep placed in the top lift of the concrete, takes care of the holding down bolt, and can be withdrawn without difficulty.

Assisting the Progress of the Work

A temporary water supply with extension pipe lines laid on the surface of the ground to the points where the concrete mixers will be stationed, will be needed. As a preliminary to building operations sleeper roads should be laid down for road traffic. Positions should be allocated for contractors' huts where they will be out of the way and will not have to be moved later on. A temporary supply from the electric light mains, or, if this is unobtainable, a portable petrol generator, should be provided so that work can be carried on after dark when necessary. Current can also be supplied from this source for motors to work the steel fixers' cranes. The use of power cranes will appreciably shorten the time of erection of steel buildings.

At an early stage a temporary stores and a temporary workshop should also be provided. In this case sectional wooden huts may be used, which can afterwards be taken down and re-erected elsewhere for other purposes. If the site is an open one it should be fenced in as soon as possible to keep out loiterers and prevent material from disappearing. It also pays to put up a temporary canteen hut if the job is a fairly large one. All that is needed is a roomy wooden hut provided with trestle tables and forms and a few slow-combustion stoves, where men can dry their clothes. A man can be got to supply hot meals and hot water for making tea, who will pay rent for being allowed to do this and will supply his own equipment. The rent so obtained will pay most of the cost of the shed, and in bad weather much time will be saved, for if the navvies and contractor's men get wet through early in the day and there is nowhere for them to shelter, they will knock off and go home, whereas if they have the canteen to go to they can start work again as soon as the rain stops.

At this point it may be well to point out the necessity for a good and simple identification system for all material, other than such things as cement, sand and so on, coming on to the site. Each building should be given a number, and every package, from steel reinforcing bars for the foundations to chemical plant, should arrive clearly marked with the number of the building for which it is destined. This saves much time in handling the material on arrival. It is also well to have the steelwork for different buildings painted different colour priming coats. In the case of plant and apparatus more exact identification is necessary, and this will be dealt with later.

If there are a large number of buildings, it will be best to arrange the construction in a definite sequence, and not start

too many at once. In this way the various stages of excavation, foundations, steel fixing, covering in and plant erection, can follow each other in an orderly way without the various contractors being in each other's way and without one having to wait for the other. Needless to say, dates for the beginning and completion of each stage on each building are worked out beforehand, and every effort must be made to adhere to these dates, or else the scheme will get out of adjustment and confusion arise.

Erection of Plant

In order to facilitate the erection later on, the ordering of the plant should be done in a systematic manner. A complete list of each plant should be made out, beginning with the main vessels and apparatus, and including all accessories, motors, pipe-lines, valves and measuring instruments. Each item should have a number, and a set of erection drawings should be prepared with every item shown in its proper position, and numbered the same as in the list. The same numbers, prefixed by the corresponding building number, should be used throughout, in sending out the inquiries, on the orders, and should be marked on the goods when delivered. Then if a package arrives on site marked B5/103 the storekeeper knows instantly that it is intended for building B5, and when the plant erectors come along they know from the erection drawings exactly where it is to go in the building. This system involves a little extra clerical work, because it means sub-dividing inquiries and orders. For instance, in a given plant there may be twenty 3 in. valves of a particular type altogether, but these may be used on six different pipe-lines, and a separate order must be given for each item. On the other hand this system has overwhelming advantages. It not only facilitates checking up whether everything has been ordered and nothing overlooked, but it greatly facilitates the following up of orders, the prevention of late deliveries, and the finding of missing items. The lists, drawings and orders form one co-ordinated whole, which automatically links up in every detail the site and the people working there with the office where the orders are placed. The best way is to incorporate the reference numbers in the order number, adding the serial number in the order book after the reference number.

In erecting the plant the overhead travelling cranes should arrive whilst the building is in course of erection, for they can then be lifted into position by the builders' or steel-fixers' derricks. It is well to get big vessels and other pieces of plant into position before the floors, staircases and handrails are put in as there is then more room to handle them.

Arrangement of Pipework

As pipework generally is an important feature of chemical factories, the workshop on the site should be well equipped with screwing machines and pipe bending apparatus. As much bending and setting as possible should be done on site. In the case of large steel pipes, such as steam mains, and cast iron lines, it will be necessary to leave closer lengths, and in some instances special bends, to be made to template after the rest of the lines have been erected. The orderly arrangement of the pipe-lines and some degree of standardisation of the supports for them is very important. It is always well to put a few extra tees in every line for future connections, and also to keep main lines on the big side so as to permit of extensions. The practice of painting pipes to show what they are carrying is frequently adopted, and is very useful—one colour for high-pressure steam, another for low-pressure, a third for town water, and others for compressed air and the various process liquids and gases.

Important main lines for steam and water should be arranged as far as possible as ring mains, or at any rate be divided into sections by isolating valves, so that, on a repair becoming necessary in one section, as little plant as possible will be put out of commission while the repair is being affected. Proper drawings should also be made of all pipe lines, and these should be kept up-to-date when alterations are made. In old chemical factories there is often no record of the run of the pipes, and much time is lost in tracing them out if anything goes wrong. It is important to have a drawing showing the position of all pipes and cables.

The electrical installation for power and lighting is important in a modern chemical factory. It is well to keep to one make of motor, and to have as few different horse-powers and speeds as possible to facilitate renewals and the keeping of spare parts. The severe conditions often met with in chemical works must be borne in mind, water and other liquids splashing about, and corrosive fumes. The ventilated motor with drip-proof cowls is the most generally useful type. Where corrosive fumes are met with the pipe-ventilated type is indicated, as also in the nighbourhood of explosive vapours. Underground cables should be lead-covered and paper-insulated, laid in trenches 18 inches deep and covered with wooden warning boards to protect them from the casual pickaxe in search of a pipe. Conduit in the process buildings, unless everything is dry and free from corrosive agents, is best avoided and cabtyre wiring on cleats is better, unless vapours which attack rubber are present, when lead-covered wiring is used. Special light fittings are obtainable which are liquid and corrosion proof, and others for use in explosive atmospheres. There is a special danger from shock where floors are generally wet, and hand lamps attached to ordinary flex are very dangerous. Only hand lamps with the fitting efficiently earthed through the third wire of a 3-wire flex should be used. Motor casings and switchgear should also be well earthed.

As the erection of each section of the plant is completed, all vessels and pipelines should be tested out with water for leaky joints, and then any lagging required can be put on. At the same time painting of steelwork, woodwork and plant where required, can be proceeded with. Finally comes the putting in of measuring instruments and the calibration of storage vessels, and the plant is then ready to start up.

Auxiliary Features

Besides the purely productive sections of the factory and the power and steam plants, a number of other items will require attention. A good general stores with well arranged bins is essential, and special stores for raw materials, oils and petrol may also be needed. A well equipped workshop, comprising machine and fitting shop, coppersmiths' and welders' shop and a smithy and a small carpenters' shop also an electricians' shop, will be needed in a fair sized factory. A shed for cycles and motor cycles is essential in even small factories, while in larger ones a canteen with baths where the men can change their clothes, wash and get meals or get the food they bring with them made hot, is an excellent investment. A garage is also an advantage, for in our days many of the staff will have their own cars. A first aid station, however simple, is imperative. In the larger factories, besides small laboratories in or near the process buildings for carrying on routine tests, a central laboratory is a great advantage.

Fire protection must be considered. Obviously the main thing is to deal with a small fire quickly and get it out quickly before it assumes dangerous proportions. Hence all buildings should be provided with chemical extinguishers, and with small hoses connected to the water mains in the building. The insurance companies will grant reduced premiums when the appliances comply with their requirements, and will supply a list of what they require for each building. For larger fires underground fire mains with hydrants well clear of the buildings should be provided. Here again the insurance companies will give advice as to the best arrangement. The stand-pipe fittings should always be interchangeable with those of the local fire brigade, and it is well to consult the chief of the brigade before the equipment is decided upon, so that the fire engines can be used to the fullest advantage if they have to be called in. In the case of inflammable liquids special apparatus, such as foamite extinguishers, may be necessary. Safety appliances for the men, such as rubber gloves and masks for use in poisonous fumes, may in some cases have to be provided, and the first aid post should contain a cylinder of oxygen if there is any risk of gas poisoning.

Finally in this planning let us insist on everything being British—cement, steel, chemical plant and glassware. Since the war British chemical engineers and plant manufacturers have made enormous strides, and practically everything that is required can be obtained in this country. If some special foreign design happens to be superior to the British article because that particular technique has been more highly developed abroad, endeavour to get the apparatus made in this country under licence; do not import it if this can be avoided.

The Phenomena and Laws of Swelling

By J. R. KATZ

We give below extracts from one of the papers contributed to the general discussion on the colloidal aspects of textile materials, arranged by the Faraday Society for its meeting at Manchester University, September 21—23.

A SOLID is said to " swell " when it takes up a liquid, whilst at the same time (a) it does not lose its apparent (microscopic) homogeneity; (b) its dimensions are enlarged; and (c) its cohesion is diminished (instead of hard and brittle, it becomes soft and flexible). Only when all three of these conditions are fulfilled may we say that real "swelling" occurs. Swelling is clearly distinct from *capillary imbibition,* such as is shown by a solid having many fine capillary canals, *e.g.*, a piece of brick. Such a solid also takes up liquids, but it is clearly *in*homogeneous, its dimensions do not change, and its cohesion is not diminished through imbibition of liquid.

Roentgen-spectrography has shown in a large number of cases that solids which can swell are built up of a large number of very minute (submicroscopical) crystals, and that those crystals have a long stretched form (being, for example, five times as long as they are thick; approximately these crystals might be, for example, 10 $\mu\mu$ thick, 50 $\mu\mu$ long). Those solids which can swell consist in the great majority of cases of substances of high molecular weight, generally polysaccharides, albuminoids or polymerised substances (*e.g.*, rubber, polystyrol). It has become very probable in recent years that all these substances of high molecular weight are built up from elongated micellæ, and that their molecules have the form of long threads. It therefore seems probable that this form of the micellæ (and therefore of the molecules) has some connection with the fact that these solids can swell. It is, however, difficult to make a complete picture of this connection. According to one possible theory, the long micellæ would form a structure like the fibres in felt. We could thus understand how it is that such bodies can take up liquids and yet not lose their cohesion entirely but only partially. One could assume, again, that the micellæ are connected to one another at certain spots of their surfaces, while other parts of these surfaces would bind the liquid by adsorption.

Moreover, another possibility occurs, namely, that the liquid is not adsorbed, or not only adsorbed, at the surface of the micellæ, but that it penetrates into the interior of the micellæ, forming something like a solid solution. The form of the molecules might then give the explanation of the fact that substances of high molecular weight are almost always swelling bodies; the attraction between the molecule-threads is much weaker than the attraction between the parts of a molecule along the length of the thread, and this might make solid solution more easily possible than in other cases.

Swelling Crystals

There also exist " swelling crystals." Since the middle of the nineteenth century albuminoid crystals (vitellins) are known which can swell (and lose water) without ceasing to behave like crystals. They can be extracted from the seeds in which they occur naturally (Risinus, cucumber, hemp, Bertholletia) by lukewarm salt solutions. When cooling these solutions, the vitellins crystallise *in vitro*. Hæmoglobin crystals are also capable of swelling. These crystals take up and lose water without any change in their apparent (microscopic) homogeneity. In aqueous solutions of many aniline dyes they take up the dye (into their interior and in homogeneous distribution), while the solution in many cases becomes colourless. While crystals as a rule do not take up foreign substances, and are therefore used for preparing substances in a pure condition, these swelling crystals have an extraordinary power of absorbing all sorts of foreign substances. Their crystal angles are often irregular and distinctly different from what they ought to be according to the crystal system; for instance, in the case of hexagonal plates, the angles might deviate up to 5° from the theoretical value of 120°. These deviations may be connected with the softness and fluidity of these crystals in a swollen condition; in a dry condition they are hard and brittle.

These swelling crystals have considerable theoretical interest. If they are really homogeneous, this would prove that at least in these cases swelling is due not to an adsorption of liquid on the surface of micellæ but to something like the formation of a solid solution. V. Nägeli, however, in 1862, doubted whether they are real crystals. Because they swell and absorb dyes he called them " Scheinkristalle," and believed that they were built up from micellæ which are regularly oriented.

The Maximum of Swelling

When a swelling substance is put into pure water it may reach a state in which no further water is taken up. This limit is called the " maximum of swelling," and substances such as maximum are called substances with " limited swelling." Most swelling substances are of this kind. Others, such as gum arabic or ovalbumine, do not reach a limit in swelling, and gradually swelling changes into solution. Such swelling is called " unlimited swelling." Formerly (1880) it was thought that this distinction was a sharp one. But in later years it has proved to be sometimes indefinite. There sometimes exist cases where it is difficult to distinguish to which of the two groups a swelling substance belongs.

In colloid chemistry and applied colloid chemistry it is often necessary to determine the water content at the maximum of swelling. For this number is a simple aspect of the tendency to swell (although not the only one). In doing so, it must be remembered that this maximum can only be correctly determined by immersing the swelling body into liquid water; saturated water vapour will not do. This fact was first noted by Deluc in 1791, while experimenting with his whalebone-hygrometer. It was later observed by von Schroeder (1903) and is sometimes called the von Schroeder effect. This however is not correct; it ought to be called the Deluc effect. Deluc and von Schroeder both observed that in " saturated " vapour a swelling body (whalebone, gelatine) will reach a different state of apparent equilibrium (absorbing less, often very much less water) than when immersed into liquid water. Deluc explained this difference by proving that the so-called " saturated " vapour was not really saturated; and that the difference disappeared if the vapour was really saturated.

Another difficulty in determining the maximum of swelling occurs in the many cases where the swelling body has no simple form. If it is, for instance, a thin plate or a sphere, after swelling it can be well separated from the liquid by drying it off with Joseph paper (or some material like this) and weighing it; then determining the water content in the maximum of swelling is a simple thing. But if the swelling body has the form of a fine powder, it will prove impossible to separate it from all capillary adhering water by pressing it off, without at the same time pressing out a certain amount of swelling water. It then is impracticable to determine directly and exactly the amount of swelling water. One then is forced to use an indirect method which may show that in one case there is more swelling in the maximum of swelling than in the other case (without determining the exact numbers). Very often it is then found useful to decant the pulverised substance in measuring glasses, or to centrifugate it, taking the volume of the decantate or centrifugate as a measure of the degree of swelling. Or if the powder is fine and equal one may determine the viscosity of the mixture, which will be found the greater—at the same concentration—the greater the degree of swelling.

Difficulties in Eliminating Swelling

It is a well-known fact that it is very difficult to eliminate the last traces of water from a substance swollen in water. If one applies vacuum at room temperature, an apparent equilibrium is reached. If, however, we then dry at a higher temperature more water is given off, the more so the higher the temperature. But soon, in increasing the degree of heat, the substance begins to turn yellow or to give other signs of decomposition. In most cases it has proved useful to dry in a vacuum over P_2O_5 at 100°; but it is not quite certain that

this eliminates all the water. In other cases drying at 110° or 120° in a current of dry nitrogen or hydrogen has been used, but the result is no more certain. In the same way it proves very difficult, almost impossible, to eliminate the last amounts of acetone or other organic liquids which have been used for preparing films of acetylcellulose. Several per cent. of the liquid may prove so firmly bound that they are not eliminated by a long drying. It therefore is more or less arbitrary, what is to be considered as a "water free" swelling substance—in making quantitative investigations about the laws of swelling in water. It is advisable to take as such a substance dried at 100° *in vacuo* over P_2O_5.

Intermicellar and Intramicellar Swelling

It is a general experience that when a swollen body has been fully dried, it never afterwards takes up so much water as it contained before drying. This holds particularly strongly for organised substances, animal or vegetable tissues, but is a general experience in working with swollen substances, and often explains practical or technical difficulties in working with such substances. It is allied to hysteresis, but may have partially a different explanation. It recalls similar experiences in the solubility of polysaccharides and albuminoids. For instance, the polysaccharide lichenine, when not yet dried, is easily soluble in warm water, but is not nearly insoluble when dried in the air; if however it is dried with absolute alcohol and ether, it remains soluble in hot water.

The first primordial question in understanding swelling is to know whether the liquid penetrates into the interior of the micellæ or is only adsorbed at their surface. X-ray spectrography can—as the author showed in 1924—answer this question to a large extent. When we find that the X-ray diagram is different before and after swelling, we can be pretty sure that liquid has been taken up into the interior of the micellæ. If the liquid is only adsorbed at the surface of the micellæ we should find no change in the X-ray diagram (surface layers giving no X-ray diagram of their own, because they are too thin; at most the amorphous diagram of the liquid can appear superimposed over the diagram of the solid). But we are not entitled to draw from the unchanged diagram the conclusion that liquid did not penetrate into the interior of the micellæ: if only one or two layers of molecules are attacked by the liquid, there may be no change in the X-ray diagram (as there is no new period of identity formed); moreover, if in the swelling substance there should be some intermicellar substance, working like lime between the bricks of a building, this intermicellar substance might be changed without influencing the X-ray diagram, because its amount is too small.

When one precipitates barium sulphate or arsenious trisulphide, no swelling substance is formed. There is no cohesion between the micellæ of the precipitate; when dried it is easily pulverised. On the contrary, if we precipitate cellulose from one of its solutions a swelling substance is formed, which has a very strong cohesion between its micellæ; when air-dried it is extremely difficult to pulverise it. What makes the difference between the two cases? Is there some connecting material which unites the micellæ of a swelling substance?

A Binding Substance

The long-stretched form of the micellæ may be the underlying cause of the difference. But the possibility occurs that there may be another cause. There might be a binding substance in a swelling substance which binds packages of micellæ together to larger, but probably still submicro-scopical, units. In grown products, tissues, fibres, starch granules, this binding substance might taken the form of membranes lying between the micellæ or between small bundles of micellæ. A good example of such a structure—but a hundred times larger, therefore microscopically visible—is given by breadcrumb. In the dough the starch granules are united by the gluten which in the wet state is elastic and plastic at the same time. In the baking process this gluten is coagulated. If now we examine thin slices of the breadcrumb, we find the starch granules—swollen through a beginning of gelatination—surrounded by a network of coagulated gluten which surrounds every starch granule (or sometimes every two or three of them), and now works between the starch granules like lime between the bricks of a wall.

Complicated phenomena are observed in the case of swelling in aqueous solutions of electrolytes. Wo. Pauli first showed that these phenomena may be explained electrically by the theory that one of the two ions is more strongly absorbed by the micellæ (on their surface only or in their interior also) than the other ion. This conception has become more and more probable. One can then explain the strong swelling (ions binding more water than micellæ). Or one water) in two different ways. One may either accept with Pauli, that the absorbed ion (and the oppositely laden ion immobilised by it) brings its sphere of water with it, and that it is the spheres of water of the ions which give the strong swelling (ions binding more water than micellæ). Or. one can explain the strong swelling through the fact that the micellæ, all laden with the same kind of electricity, are repelled from one another by electrostatic forces, and that something like a sponge is formed, in which the water enters so to say passively.

Swelling in Solution of Organic Substances

In both cases we can understand the paradoxical fact that these ions give the strongest swelling which bind the smallest amounts of water, by considering the fact that the interior of the solution and the surface of the micellæ fight, so to speak, for the ions. Therefore, the less water they bind, the easier they will be adsorbed from concentrated aqueous solutions. On the surface of the micellæ; and therefore the stronger will be the swelling they give. In this way we understand why rhodanites and iodides are very strong swelling agents, while just these ions bind little water.

It is a well-known fact that many organic substances which seem rather inactive—such as thioureum, chlorohydrate, resorcinol, benzene-sulphonates give in concentrated aqueous solutions analogous strong swelling of polysoccharides and albuminoids as rhodanides and iodides. But all substances which contain non-oxidised sulphur in organic binding give in aqueous solutions a strong swelling; thioureum is only a special case. The analogous oxygen compounds work very much less strongly than the sulphur compounds. The swelling effect can be explained by a strong adsorption of the sulphur compound on the surface of the micellæ, the hydrophile groups of the sulphur compound (*e.g.*, NH_2 in the case of thioureum) binding spheres of water, and therefore making the surface of the micellæ more hydrophilic. That sulphur compounds work much more strongly than oxygen compounds is probably due to the residual valencies of the oxygen atoms in the surface of the micellæ, which bind the sulphur of the organic molecule and therefore further the adsorption.

Comparison of Halogens

In the same way, all organic substances which contain halogens in organic binding give strong swelling. In comparing series like acetate, monochloracetate, dichloracetate, and trichloracetate, one finds the swelling and the adsorption the stronger the more halogen atoms the organic molecule contains. In comparing different halogens, iodine compounds are found to work more strongly than bromine derivatives, and bromine compounds more strongly than chlorine derivatives. Here again the residual valencies of the oxygen atoms in the surface of the micellæ probably bind the halogen atoms of the organic compound. The water is bound by the hydrophilic groups of the organic compound. In the case of phenol and resorcinol, the OH groups are probably bound by the surface of the micellæ. While in the case of benzene sulphonate the non-hydrophilic benzene group is turned towards the surface of the micellæ, the SO_3 group is turned towards the liquid, and acts as the hydrophilic group.

In this way we may give a simple explanation of the curious fact that aqeous solution of propyl and of butyl alcohol give a much stronger swelling of gelatin and casein than pure water; while these solids do not swell at all in the pure, water-free alcohols. The alcohols are adsorbed on the surface of the micellæ, turning the hydrophilic OH group to the waterside and increasing by the adsorption the water-binding capacity of the albuminoid micellæ. If there is, however, not enough water present, this effect cannot develop. Then the dehydrating effect of the alcohols prevails.

The Potential Value of Minor Discoveries in Industry

By HARRY MOORE, D.Sc.

In an article which appears in the September issue of the "Journal of Scientific Instruments," Dr. Harold Moore shows how far it is possible that discoveries of comparatively small scientific importance may lead to greater developments in industry. Extracts from the article are given below.

In considering broadly the ways in which science can assist industry, it is not unnatural to assume, at first, that it is to the more important scientific principles and discoveries that we must look for any important new industrial developments, and to some extent such an assumption may have a basis of truth. The classical example of an important scientific discovery leading to important industrial developments is, of course, the discovery of induced electric currents, which, as has been pointed out on so many occasions, led to the creation and growth of practically the whole of the heavy electrical engineering industry. Maxwell's mathematical investigations on electromagnetic waves, followed by Hertz's experiments, laid the foundations of wireless telegraphy; the discovery of the electron by Sir Joseph Thomson was the starting-point of a number of scientific investigations the results of which led to the development of wireless telephony with all its associated industries, and to the development of new types of X-ray tubes with important consequential effects on the X-ray industry. But it is by no means to be assumed that every scientific discovery of importance will necessarily have an important direct bearing on industry.

In some cases a scientific principle may have important applications which are almost of a "negative" character, in the sense that the principle may show that any attempt to achieve some specific object or result is foredoomed to failure. The formulation and acceptance of the principle of the conservation of energy, for example, have undoubtedly prevented the fruitless expenditure of much time and energy in searching after "perpetual motion." It is not unlikely that the principle of relativity may prove to be of value in much the same sort of way, but it is difficult at the present time to see any way in which this principle may lead to direct "positive" developments in industry. The quantum theory, on the other hand, already gives promise of leading to new developments having possible industrial applications. Some five or six years ago an instrument was devised for measuring the peak voltage in a high-tension circuit by measuring the wavelength of the hardest X-rays generated in an X-ray tube connected across the high-tension system. Such an instrument may, perhaps, be entirely valueless commercially under existing conditions, but its development at so early a stage in the history of the quantum hypothesis is evidence that this hypothesis has in it possibilities of practical applications which are almost certain sooner or later to be realised and developed.

Potential Industrial Value of Discoveries

The scientific discoveries and principles which have been considered above, were all of fundamental importance from the scientific standpoint, in the sense that they threw new light on the relations between magnetism and electricity, on the ultimate structure of matter, on the nature of light and radiation, and so on. But it is by no means necessary that a scientific discovery should be of fundamental scientific importance for it to prove of value in industry, any more than it is to be expected that every fundamental scientific discovery will give rise to new industries or will even affect industry directly in any important way.

The potential industrial value of many such minor scientific discoveries can be well illustrated by one or two historical examples. The telephone as at first invented was little more than a scientific toy. The power obtainable in the form of induced currents produced by speaking into the transmitting telephone was altogether too small for messages to be sent over distances exceeding a few hundred feet. Then Hughes recognised the potential industrial value of the discovery that when two pieces of carbon were held in contact, the resistance of the contact varied with the pressure between the contact surfaces. This was hardly a scientifically important discovery according to the criterion set out above, but from it the microphone was developed, and, with the microphone used as a transmitter, the power available for the transmission of messages was increased enormously, and telephonic communication over distances of many miles became practicable immediately.

It would appear highly probable that many of the minor scientific discoveries which have been made from time to time would be worth re-surveying with a view to ascertaining whether they have possible applications which would be of value in industry. This applies, perhaps, more particularly to those discoveries which provide the interesting scientific experiments shown at scientific demonstrations or lectures.

Electrical Impulses from the Neon Lamp

Examples of the applications of such discoveries in industry are much more numerous than is generally recognised. Some three or four years ago an experiment was shown, at a meeting of the Physical Society, in which a condenser was allowed to charge up slowly by connecting it through a high resistance to the 200-volt d.c. mains. Across the condenser a neon lamp was connected, and the neon lamp flashed at fairly regular intervals. The frequency of the flashes could be increased by reducing the resistance through which the condenser was charged, or by reducing the capacity of the condenser. The energy of the discharges through the neon lamp could be varied by increasing the capacity of the condenser, and so on. It was a very interesting demonstration and gave an excellent illustration of certain physical phenomena such as the catastrophic ionisation which occurs in neon lamps when the potential difference between the electrodes of the lamp reaches some fairly definite value, and it showed also that the gas, when once ionised, remained so until the potential difference across the lamp had fallen to a value appreciably lower than that required to initiate the discharge.

Then it occurred to somebody that this arrangement afforded a way of producing electrical impulses succeeding each other at regular intervals without the need for any form of clockwork or other moving mechanism. The series of impulses could be started at any moment by simply switching on the d.c. supply, and relays set in operation by the impulses could be utilised in a very large number of ways. As one outcome of this interesting property of the neon lamp, there has been devised an automatic traffic-control system which is almost uncanny in its adaptability to varying traffic conditions.

Ionisation Potential of Gases

Commercial use has been made, also, of the differences which exist between the ionisation potentials of different vapours and gases. One interesting example of this is afforded by a battery-charging apparatus brought out some four or five years ago. In this a rectifying valve with a hot cathode is used; the residual gas in the valve consists mainly of argon, though the valve also contains a few globules of mercury. The discharge through the valve is carried initially by the argon, the voltage impressed across the valve being of the order of 20 to 25 volts (r.m.s.). This is sufficient to ionise the argon, but the amount of argon present is too small for any large current to pass. As the valve becomes heated, however, mercury vapour in considerable quantity is produced. The ionisation potential of mercury vapour is of the order of 5 volts as compared with about 17 volts for argon and, as a result, the potential difference across the valve rapidly falls as the mercury volatilises, while the current through the valve increases.

In this same apparatus another interesting application of a comparatively unimportant scientific discovery is used to regulate automatically the output of the valve. This is the same in principle as that used to regulate the current through the "glower" of a Nernst lamp, and consists of an iron wire resistance enclosed in an evacuated glass bulb. The advantage of such a resistance depends on the fact that the specific resistance of iron increases very rapidly over the temperature range between 300° C. and 700° C. By means of resistances of this type it is possible automatically to keep the current passing through

a circuit constant at some desired value within quite small limits, even when the voltage operating in the circuit varies very considerably, provided the resistances are so chosen that they are kept at a temperature of 500° C. to 550° C. when carrying a current of the desired value.

Other illustrations could be given almost without number. For example, the fact that the solubility of helium in water—and consequently in the human blood—is less than that of nitrogen has proved of considerable value in connection with diving operations; the rotation of the plane of polarisation of a beam of light passing through certain media when the media are placed in a magnetic field is the basis of one method of reproducing speech and sound in connection with the kinematograph industry; the discovery that cellulose can be dissolved by alkaline thio-carbonates and can then be coagulated by means of certain acids is the foundation of one branch of the artificial silk industry; and so on. There is little to be gained, however, by simply adding example to example, and probably sufficient has been said already to indicate that the scientific discoveries which have led to important industrial developments are by no means restricted to those which would be considered as of fundamental scientific importance.

The extent to which scientific discoveries, whether of major or minor importance, can be utilised in fostering or creating industrial developments depends, however, in a large measure, on how far industrial needs are made known to the scientist. Much can be done in the direction of applying scientific knowledge in industry, as the research associations have shown, by bringing industrialists and scientists into closer contact. More might be done, perhaps, if manufacturers were encouraged not to limit their inquiries to matters relating to processes or to projects which they recognise as being essentially practicable, but to put forward, for discussion, ideas of what they consider would be desirable in their own particular branch of industry, even though they may have little hope of the desired result being achieved. Properly handled, informal discussions along such lines might prove of great value. In discussing any project put forward, the scientist should not be too didactic in saying what is or what is not possible.

The Chemical Industry in Switzerland

Increased Exports of Dyes

SWITZERLAND is popularly believed to be an agricultural country which lives mostly on its exports of milk, cheese and milk chocolate and on the profits of its hotels. In reality it is a highly industrialised country whose industries employ 46 per cent. of her working population (metals and machinery 8.9 per cent., textiles 8 per cent., foodstuffs 4.1 per cent., watches 3.8 per cent.), whereas agriculture employs only 28 per cent. The goods produced are almost exclusively of high quality and finish. It is not surprising therefore that in 1931 Great Britain should have been Switzerland's best customer. It is unfortunate, however, that in the past, disadvantages of price, language and geographical position, when compared with neighbouring countries, have prevented Great Britain from supplying an adequate share of the metals and semi--manufactured metals which Switzerland's industries are obliged to import. The recent fall in the exchange value of the pound sterling has altered the price factor, and the Swiss market, if properly handled, should now prove a good outlet for British metals and semi-manufactured goods.

The Swiss are by nature industrious, thrifty and honest in business. These qualities, combined with the careful finance of Swiss bankers, maintained the country almost unaffected by the world crisis until the end of 1930. It was not until the middle of 1931, when outside events of considerable magnitude, such as the financial crises in Germany and Central Europe, the depreciation of sterling and the import restrictions introduced by France and Great Britain directly affected Switzerland's foreign trade, that the crisis was seriously felt. The high reputation of Swiss bankers for conservative methods and also perhaps the uncertain conditions existing elsewhere led throughout the year to a steady influx of capital, which involved large imports of gold. Consequently Switzerland was able to maintain the lowest bank rate in the world, and at the end of 1931 had 145 per cent. gold cover in spite of an increased note currency.

Effects of the Crisis

In a report on "Economic Conditions in Switzerland," published for the Department of Overseas Trade by H.M. Stationery Office (1s. 6d. net), Major H. F. Heywood, the Commercial Secretary to the British Legation at Berne, states that the pharmaceutical, chemical and dye industries have suffered less than the majority of Swiss industries from the general economic crisis. The pharmaceutical industry suffered to some extent from French competition and the new measures of economy introduced by hospitals and insurance oragnisations, both at home and abroad. The principal articles of export were powders, pastilles, salves, perfumery, vegetable alkaloids and prepared foodstuffs. Partly owing to a decline in prices exports fell by four million frs. (from 49.0 to 45.2 million frs.). In the chemical industry there was a fall of three million frs. in exports (from 33.0 to 30.6 million frs.). Exports of various peroxides, oil of cloves and lavender oil increased, and those of gelatines, chlorates, salt-petre and methylated spirits decreased.

The dye industry possesses an excellent organisation abroad. Moreover analine dyes are used chiefly for woollen tissues, which are at present more in demand than cotton or silk. Exports increased from 66.9 million frs. in 1930 to 67.4 million frs. in 1931. Events in China and Japan caused a considerable decrease in exports of indigo to those countries.

Artificial Silk

The artificial silk industry, which provides employment for some 5,000 persons and until a short time ago occupied a prosperous position, has been seriously affected, particularly in its export activities, by the general economic depression. The devaluation of the yen has also made Japanese competition formidable not only on the Eastern, but also on the European markets.

Foreign competition has been very keen at home, where prices were abnormally low. The higher cost of production of the Swiss article handicapped its sale, even when no margin was left for profits. There is no adequate tariff protection for rayon products, the present duty amounting to only 2 centimes per kilogramme.

Although the rayon manufacturers are still fully occupied, it will probably prove impossible for them to maintain their present output very much longer. Exports of artificial silk in 1930 and 1931 were:—

1930		1931	
Tons	Million frs.	Tons	Million frs.
4,221	40.1	4,512	37.7
Imports for the same period were:—			
1,889	24.7	2,461	21.1

Paper and Cellulose

Efforts were made during recent years to develop the export possibilities of the paper industry. In 1931, however, exports of paper and cardboard, not printed, decreased by about half (from 6.5 to 3.9 million frs.) and although imports also showed a decline (from 14.0 to 13.8 million frs.) foreign goods were put on the Swiss market at prices below local cost of production, so that a number of firms were obliged to limit their output. The unfavourable situation in the industry reacted on the timber trade, for paper manufacturers could not absorb all the timber which had been cut down for their use. The cellulose industry was also hard hit by the prevailing conditions. In spite of the restrictions introduced in the principal timber exporting countries cellulose could be bought on the world market at prices which obviously could not cover the full cost of production. Exports of cellulose, etc., amounted to 5,344 tons and 1.5 million frs. as compared with 6,089 tons and 2.1 million frs. in 1930. The importation of cellulose into Switzerland from all countries was restricted by a measure passed in February, 1932.

The Autumn Outlook in the Chemical Industry

Present Position and Future Prospects

A YEAR ago the world's financial centres were shaken to their foundations by the news that Great Britain had been compelled to abandon the gold standard. The Bank Rate soared to 6 per cent. and the Stock Exchange was temporarily closed. To-day the pound is steady, the Bank Rate is down to 2 per cent. and the Stock Exchange is active. In whatever direction we look we are getting through the wood—getting to a natural world that we can understand. The chemical and allied industries have had a particularyl difficult year, but if statistics prove anything at all they indicate an upward trend. There is a more optimistic spirit abroad to-day than has prevailed for many months. We have invited leading men in various branches of industry to express their views on the present position and the outlook for the coming winter, and the following contributions serve to show the trend of feeling at the present time.

A YEAR ago our departure from the gold standard was taken universally to herald an inevitable advance in the prices of practically all chemicals in this country. The example of the conditions ruling in Germany during the inflation period was in some degree the cause of this, but the enormous importance of preventing an undue rise in the cost of living was largely responsible for the cautious attitude of manufacturers, and the maintenance of steady prices in the autumn of 1931. Very soon, however, it was seen that the world depression was a far more powerful factor governing prices than any local conditions, and so far from an advance in most commodities on this market, prices have steadily declined. The desperate need of foreign countries to maintain their export trade caused them to continue to send goods into this market with little regard to cost or profit. Nevertheless the determination of British manufacturers to extend their business, combined with a wave of patriotism on the part of home buyers, has led to a steady expansion of the use of British products in this country. This has been particularly noticeable in the case of solvents and other chemicals used in industry, which is a valuable indication of the trend of trade generally. Any attempt to prophesy would obviously be extremely foolish, but the immediate outlook certainly seems to justify optimism as regard this market, though the lack of cash in the case of buyers in many countries abroad continues largely to neutralise our advantage in being able to sell in sterling in competition with nations still on the gold standard. The folly of giving long credit to buyers in impoverished countries has been so abundantly proved during the past two years that restriction of export trade by sound sellers must for a time continue to be almost automatic, but the return of confidence which to-day seems to be increasing, must inevitably tend to an upward trend in the price of commodities, which will ultimately react favourably on the pockets of buyers throughout the world. This should increase our export sales to foreigners who are ready enough to buy in sterling, but at present are handicapped by lack of cash and by the stringent restriction imposed by their Governments on the purchase of foreign exchange. As a proof of our conviction that better times are ahead, we have taken the step of making large extensions and improvements in our plant, as we believe that this is one of the wisest forms of investment open to up-to-date manufacturers to-day.—[Geoffrey E. Howard, managing director, Howards and Sons, Ltd.]

The Ceramic Industry

For some eight or nine years past most branches of the ceramic industry have had unenviable experiences, which gradually got worse until extreme depression was reached last year, and the first half of the current year was little, if any, better. During this period many significant movements took place. In the Potteries district of North Staffordshire negotiations for working agreements or purchase resulted in an unprecedented series of amalgamations of various factories, and these operations were extended so as to include some important and well-known establishments in other parts of the country—notably those at Derby, Worcester, and Coalport. The Coalport manufacture was transferred completely to Stoke-on-Trent, where an entirely new factory, adjoining the famous old Cauldon works, was erected for carrying on the production of Coalport porcelain. A number of the works thus taken over were discarded for manufacturing purposes, industrial operations being concentrated in the larger and better-fitted factories.

Meanwhile world conditions became more and more unsettled, tariffs and other restrictive measures made international trade increasingly difficult, besides adversely affecting international transport, and when the last (and highest) American tariff scheme came into force, with the professed object of securing home markets for American producers, the effects were disastrous to foreign traders—and no less so to Americans, for with the expected fall in imports ensued an even greater (though presumably unexpected) fall in exports.

The international situation was further complicated when the British Government imposed protective tariffs. It was predicted that this step would have the effect of reducing substantially the appalling numbers suffering from the evil results of unemployment. The evidence so far seems to point obstinately in the opposite direction. Such perversity in the course of events is lamentable, but can scarcely be termed surprising when it is remembered that practically every trading nation has been and is making strenuous efforts to cut down imports to a minimum, and at the same time is expecting—or at least hoping—to increase exports. The recent experience of the United States seems to prove conclusively the hopelessness of such a policy, as no country ever had better chances of success, if success were possible.

A Vague Expectancy of Better Times

There are certain considerations which affect the pottery trade perhaps to a greater extent than many others. Apart from the circumstance that the concentration of manufacturing operations in fewer works must place the smaller independent works at a disadvantage—quite a number of firms have been already snuffed out by the hard times, including one or two with up-to-date equipment—the larger firms which formerly manufactured almost exclusively for North and South American markets, or both, are in serious competition with all the other makers for the home market.

As to the future of pottery in this country, it is by no means easy to forecast the course of trade for even a few months ahead, but there is a rather vague expectancy of better times to come. The manufacturers of the highest grades of ware were among the last to feel the full effects of the abnormal conditions of world trade, for it was not until the American tariff was made practically prohibitive that their sales abroad became almost negligibly small.

The general earthenware manufacturers have hopes of better business as the result of the Ottawa Conference and other influences. There are certainly small indications of revival in parts of South America and in Australia, and it is to be hoped that these and other glimmerings may turn out to be pointers to early and widespread upward movements of trade. At least one well-equipped firm making good medium grade earthenware has quite recently entered upon a period of considerable activity, but it remains to be seen how long it continues. Some small bits of foregn business have come to one of the high grade ware manufacturers. May the turn prove to be really at hand at long last, for this and other trades! Future prospects, however, must depend largely on the results of the forthcoming Economic Conference.—[J. A. Audley, Stoke-on-Trent.]

The Leather Industry

To forecast the future trend of trade in a particular industry or article is a risky undertaking at the best of times; more so at the present and in regard to a commodity such as leather, which, similar to most primary articles, is in the long run dependent upon consumer demand for prosperity or otherwise. Under such circumstances, the best that can be done is to survey events as they are at the moment and to give a hopeful anticipation of what may be the ultimate result of these. Dealing first with the most important raw material of

the industry—hides and skins, prices for which for a long time past have ruled very low, values for these have now reached a more economic level, if there is such a factor for an article which is a by-product of another industry. What is exercising the mind of the tanning trade at the moment is whether, for some reason or another, prices will be forced up to a greater extent than the immediate inquiry for leather warrants. In the event of this happening, there can be only one outcome—a considerable falling off in demand and a reduction in quotations; there can be no great diminuation in supplies because, as previously indicated, hides and skins in the main are a by-product of the meat industry, and their rate of production largely depends upon the consumption of this article of food.

Brighter Conditions

Brighter conditions are also observable in the leather manufacturing trade, although it is more than likely that the majority of the larger concerns are still working short of capacity. Sales, particularly those of sole leather, have been affected by the rising hide and skin market and purchases of late have been on a larger scale than they have been for some considerable time. It does not appear, however, that all the stock which has recently changed hands has been needed for immediate or near future needs, and if confirmation of this were required it is to be had in the fact that production of footwear during the period of this more active buying showed no signs of expansion. The dressed leather trade has undoubtedly received some benefit by the imposition of the tariff, and although the rate of progress may be slow, home producers have made some headway, a fact which is confirmed by the reduced quantities of certain descriptions of upper leathers now coming to this country from abroad.

This section of the industry is perhaps influenced to a greater extent than any other by the purchasing power—or lack of it—of the public, particularly what might be termed the fashion end. An urgent need at the moment, therefore, is a larger demand than at present obtains, and this can only come through increased purchases of boots and shoes. It will be realised from these facts that although the present position of the leather industry is brighter than it was, say, three months ago, an important factor in regard to the future will be the demand from the public for boots and shoes. Increase the purchasing power in this direction and there is no reason why the industry should not continue to make satisfactory progress. On the other hand the persistent rise in the figures of the unemployed does not augur well for a larger sale of footwear. It may be, however, that the negotiations which have taken place between the tanning trade of England and the Colonies in connection with the recent Ottawa conference will have a very material effect on the future of the leather industry which is one of the oldest in this country.—[A. Harvey, International Society of Leather Trades Chemists].

Glass and Glass Technology

The glass industry all over the world is in a depressed state. Relatively to other industries it is perhaps no worse and, in our own country, it has done substantially better than many industries of late. In America the general decline in production was still continuing at the middle of the year, whilst the effect of world conditions coupled with the special effect of the British tariffs and departure from the gold standard have had disastrous effects on glass production in Germany, Czechoslovakia, Belgium and Holland, whilst Sweden has experienced a prolonged strike.

The anticipated benefit of the tariff on production in this country has been offset first of all by the general difficulties of export markets and in certain special cases by the incidence of taxation. Thus, the glass bottle industry has been very seriously affected by the more recent additions to the beer tax. The effect has been to compel manufacturers of these bottles to seek new outlets, in some cases by the manufacture of articles already produced by quite a number of other manufacturers, so that competition and price-cutting have become exceptionally severe. Not unnaturally, cut glass and in general artistic glass sales, being of a luxury character, have declined. Certain lines of domestic glassware have undergone considerable development since the application of the tariff and at least three factories have become equipped and got into operation for the automatic production of the cheaper lines of glass dishes and bowls, glass tumblers, etc. A very promising beginning indeed has been made with such manufacture. Those factories operated by pot furnaces which have been engaged in making illuminating glassware and miscellaneous ware have been busier during the past twelve months than for several years past and the difficulties have been not lack of demand but inability to cope as expeditiously as the manufacturer desires with the orders presented.

Technological Activities

Glass technological activities continue to increase despite the position of world trade. America has just founded its first Department of Glass Technology, at Alfred University, New York State, with Dr. S. R. Scholes as first professor. News of new ventures in glass research institution has come recently from Czechoslovakia and from Shanghai. The three countries most active in promoting scientific research on glass at the present time are this country, Germany and Russia. The activity of the last-named is quite remarkable. A series of small textbooks is being poured out by a variety of authors and numerous communications to the technical periodicals are being made.

Financial difficulties are beginning to hamper some of the German Institutions but the Deutsche Glastechnische Gesellschaft is still receiving strong support. Between that body and the Society of Glass Technology in England active cooperation in regard to standards continues. In the work of the Department of Glass Technology at Sheffield and that of the Society of Glass Technology there has been no diminution. Rather there has been increased activity, and the Transactions of the Society of Glass Technology in the current year promises to contain a larger number of papers, a number of first-rate importance, than any previous volume. The Glass Manufacturers' Federation and the Society of Glass Technology have decided to hold a Glass Convention in May of next year, whilst suggestions for a meeting of the Society to be held abroad in the late summer of 1933 are under discussion. These facts indicate confidence as well as courage. —[Professor W. E. S. Turner, Department of Glass Technology, Sheffield University.]

Industrial Silicosis

A New Memorandum Issued by the Home Office

The serious nature of silicosis amongst industrial workers is emphasised in a memorandum which has just been issued by the Home Office. During the last three years, states this memorandum, there have been eighty cases, including thirty deaths, amongst workmen employed in ganister mines and silica brick works; 179 cases, including 25 deaths, in the getting and manipulation of sandstone at quarries or on premises worked in conjunction therewith; 322 cases, including 87 deaths, in the pottery industry; 81 cases, including 32 deaths, in the metal industries, including metal grinding and sandblasting; and 91 cases, including 20 deaths, in coal mines. These figures show a total of 753 cases, of which 194 ended fatally.

The disease is produced by the action of minute particles of silica dust, the main constituent of many rocks, such as quartz, sandstone, flint and churt, on the lungs. Minute particles of silica float in the air during certain industrial operations. They are inhaled by the workmen, passed through the bronchial tubes, and so reach the air-sacs which constitute the respiratory tissue of the lungs. Here they set up an inflammatory process, and according to the memorandum, " once this process has commenced nothing can stop its progress, and it proceeds, more or less slowly, producing a kind of scar tissue (fibrosis) which ultimately replaces the lung substance, at first in small spots or nodules which may become joined up to form larger areas. "

Regulations are in force prescribing certain preventive measures, including special methods of ventilation and the wearing of respirators, which, however, the memorandum states, afford insufficient protection. It is hoped, however, that before long a respirator possessing the necessary properties will be produced.

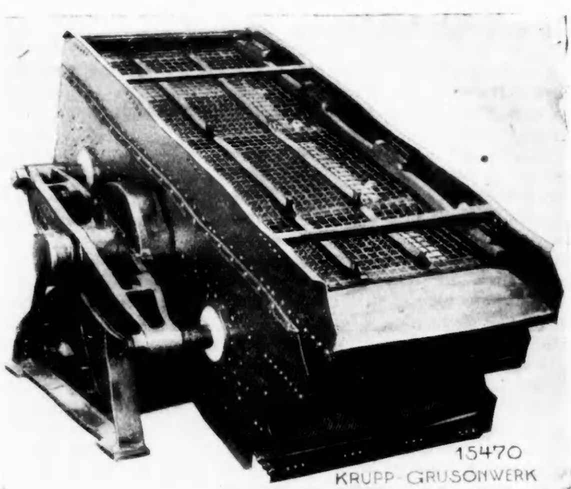
A New Universal Vibratory Screen

Its Constructional Features and Advantages

THE capabilities of screening and grading plants have been raised enormously in recent years by the introduction of modern high duty screening machines. Many designs of high frequency vibrating screens have arisen, whose oscillatory motion is brought about by striking gear, electro-magnets, unbalanced members or slightly eccentric crank-shafts. The most important task in connection with such screens has been to obtain the mastery over the kinetic energy of the rapidly oscillating masses and so to balance it out that the transmission of vibration to the building is obviated. Such requirements have been met with particular success in the universal vibratory screen, which has been placed on the market by Fried. Krupp Grusonwerk A.-G., whose English agents are J. Rolland and Co. In the design of this screen the developments in oscillation technology embodied in the Schieferstein system have been skilfully employed, and the screen has already given the greatest satisfaction for fine and coarse screening, both wet and dry, under the heaviest loading and under adverse working conditions.

Methods of Operation

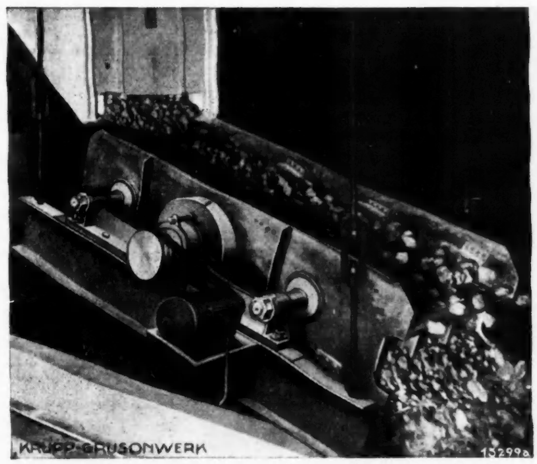
The screen box in which one to three screening surfaces can be arranged one above the other, is carried by four rubber cushions. A high speed eccentric shaft, which passes through the middle of the screen box, sets the latter in circular oscillation. The forces thereby caused to act upon the crankshaft bearings are compensated by flywheels, provided with balance weights. With the system of compensation the forces first act at the four points of suspension of the screen box, upon the annular rubber cushions, the directions of thrust corresponding to the position of the eccentrics at the particular moment. The reaction of each pair of cushions is transmitted by a common spindle to the traverses connecting the points of suspension, where it balances out with the forces from the flywheels. As the rubber cushions are designed in the form of short cylinders, through the middle of which run the carrying spindles, the forces continually set up around the circle—which may be



Universal Vibratory Screen : Three-Decker Pattern

compared to a rotary magnetic field—are equal at all points, so that a completely circular motion of the screen box results. It is necessary to aim at this perfectly circular motion because the centrifugal forces produced by the moving masses (screen box and balance weights) only balance out when both masses follow similar curves, in this case, circles. The screen box is held in the generously proportioned rubber cushions, which absorb a part of the oscillation energy, and rests therein in absolutely stable fashion, making exactly circular oscillations, even under the heaviest loads, such as pieces up to half a yard in length.

In this screen all moving parts are so calculated that the forces they set up are, with correct adjustment of the balance weights, completely counterbalanced, both statically and dynamically. The eccentric shaft runs in heavy self-aligning roller bearings carried in the frame of the machine, and the shaft itself makes no oscillatory motion—a special advantage of this design of vibrating screen. Both the eccentric sleeves in the screen box and the bearings in the machine frame have highly efficient labyrinth packing for the exclusion of dust, dirt and water. Easy bearing renewal has been taken care



The Universal Vibratory Screen as installed at a Gasworks

of. The flywheels with the adjustable balance weights are accessibly mounted on the driving shaft between the eccentric sleeves and the bearings in the machine frame. The screen box is built up from thick steel plates, riveted and welded together in box girder form. Modern methods of design and construction ensure the screen box standing up to the high rate of oscillation, in continuous service and under the heaviest loading. In the side walls are firmly mounted the eccentric sleeves and the housings for the rubber cushions, etc.

The Screen Cloth

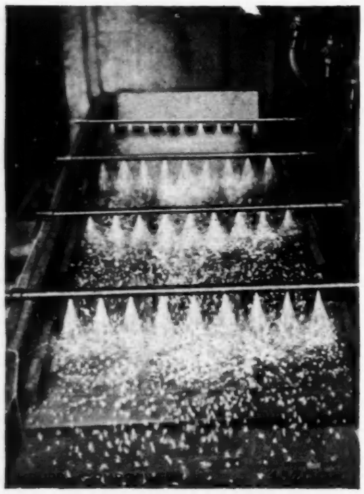
Suitable fittings are provided to take the screen cloth. According to the number of sizes to which the material fed is to be separated, one, two or three screen decks are arranged one above the other. For mesh sizes up to 15 mm. (0.6 in.) aperture, screen cloths are employed which are gripped in tensioning strips and stretched taut like a drum skin over oval-section cross-bars. Where the aperture exceeds 15 mm. (0.6 in.), use is made of screen "cloth" held in a frame, which is secured in the middle by wedge-bolts and at the sides by wooden wedges. These methods of fixing enable the cloth to be rapidly changed. Screens are supplied with screen cloths having from the finest mesh up to square apertures of about 150 mm. (6 in.). The cloths are woven from high-grade spring steel wire, which permits of a thin gauge wire being selected, giving an open screening surface with a large discharge area. If particularly heavy wear has to be reckoned with the cloths are made of special manganese steel. For moist fine material, cloths of phosphor bronze are utilised; for the chemical and foodstuffs industries, where chemical action has to be prevented, screen cloths of stainless steel, copper, etc., are also furnished. Stretched fine-mesh cloths are made particularly strong in the direction of pull, in order that they can be brought to a good tension without suffering distortion.

If material of uniform grain shape is to be screened, in which no flat, flaky constituents are present, long mesh

screens and screens having a large open area may be employed, in order to increase screening capacity and efficiency. For material in large lumps and of a hard nature perforated screen plates are also suitable. These are manufactured of wear-resisting steel in the makers' own shops. It should not be overlooked, however, that perforated plates have a less open screening surface than have woven wire screens. To drain fine coal, wedge wire sieves are made use of, these giving, at the high rate of oscillation employed, a good drainage effect. The special advantages of the wedge wire sieve are maximum permeability; no clogging of the slots (as these widen from on top to below), and a large carrying capacity.

Adjustment of Screening Angle

In the simplest arrangement the traverses that carry the rubber cushion anchorage spindles and the main bearings are mounted on a steel channel frame, the latter being given whatever inclination may be required. Alterations in the angle are effected by the insertion of wedges under the channel frame. When equipped in this way with a frame of steel channels the screen can also be suspended from overhead supports if circumstances make this desirable. Fine adjustment of the screening angle is then carried out by the aid of turnbuckles in the suspension rods. Under normal working conditions the screen is belt-driven from shafting or from an electric motor or other prime mover. The



The Universal Vibratory Screen fitted with Water Sprays

simplest method of drive is the Texrope V-belt drive from an electric motor. If the eccentric shaft speed and the motor speed agree, then direct drive by electric motor is possible, employing a flexible coupling.

Dust Protection

For dusty material the screen box can be equipped with a discharge trough to carry away the fine discharge, in so far as the size and type of the machine and the nature of the screened material permit. Feed and discharge chutes, which in no case must oscillate with the screen box, can be connected up by means of a bellows-like attachment of some close fabric or leather. In this way, also, a fixed discharge hopper mounted under the screen may be connected to the screen box, when a discharge trough oscillating with the screen box cannot be arranged for.

To facilitate the screening of wet material and to provide a means, in the case of a moist feed, of washing away the fine grains adhering to the coarse grains, the screen is fitted with water-spray equipment. A number of stationary sprinkler pipes are fixed tranversely across the screening area, being connected with the supply line by rubber hoses. It is advisable to arrange for regulating cocks in the supply pipes, by means of which the effect of the wash water on the screening area can be controlled.

As the whole screen surface is active in the work of screening, it is a necessary condition to the high working capacity that the feed shall be uniformly distributed over the entire width of the screen; the feed chutes need to be arranged accordingly. Also, when fixing the chutes, care must be taken that none of the material being screened gets caught between the chutes and the oscillating screen box. Generally, the circular oscillations of the screening surface take place in the direction of flow of the material upon it. In order to achieve particularly sharp separation, however, the direction of rotation may be reversed, so that the oscillations are opposed to the flow of material. Such a method of running has as a consequence that the material is retained longer on the screening surface and hence more sharply sieved out. The larger screening angle necessary must be adapted to the required output and to the grain size. The output depends in a high degree on the physical properties and shape of the grains, as also the screen analysis and moisture content of the feed. The screening efficiency and likewise the output are considerably influenced by the percentage in the feed of grains whose size is of practically the same order as that of the mesh apertures.

Linoleum Manufacture

A New Process for Speeding-Up Production

LINOLEUM consists essentially of linoxyn—autoxidised linseed oil—compounded with fillers such as cork and wood flour by mixing, kneading and rolling operations. A revolutionary departure from this system, which depends for its success in no small measure upon the efficiency of somewhat lengthy mechanical mixing operations, has been announced by the N. V. Niederlandsche Linoleumfabrik (Ger. Pat. No. 542,693). Here the fillers and linoyxn are separately emulsified in suitable media and the two emulsions thoroughly mixed together, this operation being carried out far more expeditiously than the conventional dry mix. The whole is then coagulated by passage of an electric current, and the conditions can be so adjusted as to enable the coagulated material to be directly obtained in sheets which only require drying and pressing.

Analytical Examination of Cellulose

Estimation of α, β and γ Varieties

PROCEDURE for the analytical examination of cellulose has recently been devised by M. de Fayard of the Pierroton Forest Laboratory ("Bull. Inst. Pin." 1932, p. 189). One gm. of the dry cellulose material is treated with 50 cc. of sodium hypochlorite solution, (50 gm. bleaching powder and 50 gm. sodium carbonate mixed with a convenient quantity of water, filtered and made up to 1,000 cc.) and maintained at 30°-35° C. for 8-10 minutes. when 0.5 cc. glacial acetic acid is added, the beaker covered with a clock glass and left standing until perfectly white. This is usually from 2-3 hours. The mixture is filtered through a weighed Gooch crucible, washed with a litre of water, and the crucible then placed in 2 per cent. sodium sulphite solution at 100° C. for 15 minutes. When filtered again through the Gooch, the residue is washed with 50 cc. of boiling 2 per cent. sodium sulphite solution, and then water. The lignin-free cellulose is carefully treated with 20 cc. of 0.5 per cent. potassium permanganate solution, and decolourised with SO_2. Finally, the cellulose is washed with water, alcohol and ether, dried at 100°-103° C. and weighed. This represents total cellulose.

The above cellulose with crucible is put into a 50 cc. beaker with 25-30 cc. of 17.5 per cent. (wt.) NaOH solution, and heated to 60° C. for 1 minute. The liquid is filtered and the filtrate returned if at all cloudy. The residue is washed with about 250 cc. of hot water, dried, and the α cellulose weighed. The alkaline filtrate and washings are united and the β-cellulose precipitated by the addition of a sufficient quantity of glacial acetic acid. The liquid is heated to 100° C. to coagulate with the β-cellulose, which is next filtered through a tared double filter paper, washed with water made slightly acid with acetic acid, dried and weighed. The γ-cellulose is obtained by subtracting the sum of the and β-cellulose from the total cellulose. The method is shorter than the Cross and Bevan method, and gives results comparable to those from this latter.

Glasgow Technical College

Course of Instruction in Technical Chemistry

The calendar of the Royal Technical College, Glasgow, for the Session 1932-33, contains full particulars of the day and evening courses offered in inorganic, organic and physical chemistry; fuels and their application; dyes and their application; sugar manufacture, metallurgy, and other subjects.

The chemical laboratories at this college are equipped with experimental plant with which the student is required to prepare a variety of substances in sufficiently large quantities to furnish data regarding yields and costs, for the purpose of giving him an insight into the methods of attacking industrial problems. This plant includes mills, vacuum filters, filter presses, a hydraulic press, hydro-extractors, a double-jacketed steam-heated pan, a double-effect vacuum evaporator with 40 square feet of heating surface, a vacuum pan with jacketed crystallisers and a motor-driven hydro-extractor, a column still, an extractor of ten litres capacity, a refrigerating plant, and arrangements for precipitating, crystallising, and drying. Special attention is given to the methods of valuing fuels and controlling their use. This course of instruction includes gas analysis and fuel analysis generally, the determination of the calorific values of solid, liquid and gaseous fuels by the bomb, Junkers, and other types of calorimeter, the measurement of high temperatures by means of the various types of pyrometer used industrially, experiments in gas production, and the estimation of heat losses in combustion.

A special course of instruction on the analysis of sugars and of the raw products of the sugar factory is provided.

The Preservation of Orange Juice

Factors which Affect Flavour and Colour

Some idea as to just how difficult it is permanently to preserve orange juice in its natural state is given by M. A. Jaslyn in "Industrial and Engineering Chemistry," 1932, *24*, 665. Complex changes rapidly take place after extraction of the juice from the fruit. These changes may be due to living organisms, easily prevented by pasteurisation; due to enzymes only partially controlled by pasteurisation; and due to oxidation and chemical reactions between the normal constituents of the juice. Although unpasteurised orange juice stored at 32° F. will maintain its colour, it loses its flavour, and develops a stale, disagreeable taste. Even frozen orange juice can lose its flavour if precautions against oxidation are not taken. Juice from immature fruit is apt to become objectionably stale in flavour, while that from over-mature fruit tends to become flat in storage.

Not every variety of orange gives juice suitable for preserving. In California the Valencia is superior to the Navel. In Florida there is a decided advantage in using only one or two varieties which can be depended upon for uniformity in quality of the juice. Florida oranges are generally higher in sugar content, lower in acid and not so highly coloured nor so fully flavoured as similar varieties grown in California. Juice extracted from tree-ripened oranges shortly after picking is superior to that extracted from oranges held in storage. The flavour of orange juice is also markedly impaired by even small quantities of copper and iron salts, as well as other metals in solution. Aluminium and stainless steels are superior to other metals for the handling of orange juice, and nickel may be satisfactory under certain conditions. Tin, tin-plated copper, nickel-plated copper or the nickel-copper alloys have not been found satisfactory.

The freezing of orange juice usually causes the pulp to settle out upon thawing, whereas it remains suspended under ordinary conditions. Up to the present, the most satisfactory product has been obtained with orange juice extracted with a minimum of metallic contamination, under sanitary conditions from sound, clean, mature, tree-ripened fruit containing little or no oil from the peel and the minimum albedo, completely deaerated after straining to remove coarse pieces of pulp and seed, packed, preferably under vacuum or in an inert gas in air-tight liquid-tight containers, and rapidly frozen after extraction.

Acetate Products Corporation

Reorganisation Scheme

A scheme is being put forward for reorganising the Acetate Products Corporation, which went into liquidation last year. A new company is to be formed with a capital of £55,000, divided into 2s. shares, and this concern will purchase the whole of the assets from the liquidator of the old company for £65,000, to be satisfied by the allotment of all the shares of the new company and as to £10,000 in cash, the latter being required to discharge in full the existing creditors. To provide the cash it is proposed that the new company shall create £100,000 of 8 per cent. debenture stock and issue £55,000 of this stock at par. It is estimated that the scheme will provide £37,500 of fresh working capital. The new company will take over the fully equipped factory, which was erected at a total cost of £180,000.

In a circular in connection with the affairs of the company, Sir W. H. Peat, the liquidator, reports that creditors' claims have been discharged to the extent of 13s. 4d. in the £ out of assets which have been gradually realised. The principal asset of the company, which is represented by the leasehold factory at Croydon and the plant and machinery, which was built for the manufacture of acetate sheeting and kindred products, has not yet been sold.

The Melchett Medal for 1932

Institute of Fuel Award

The Council of the Institute of Fuel has decided to present the Melchett Medal for 1932 to Mr. Charles M. Schwab, who is coming over from the United States for the purpose of receiving this medal and will give a short address to the members of the Institute in the lecture theatre at the Institution of Electrical Engineers, on October 19, immediately following the president's annual address. The medal will be presented to Mr. Schwab at the annual dinner on the evening of the same day. The Council will give the members of the Pilgrims, the American Society in London, and the American Club an opportunity of being present at the meeting in the morning and also at the presentation in the evening, in order that they may have an opportunity of joining in the welcome extended to Mr. Schwab, and also of honouring one of their own countrymen by their presence at these functions. Mr. Schwab is the third recipient of the Melchett Medal. The first medal was awarded to Dr. Kurt Rummel, of Germany, and the second was presented to Professor W. A. Bone on February 1 of this year.

Whilst Mr. Schwab has spent most of his time in America, he is well known in this country for the outstanding work he has done in the development of the iron and steel industry, which necessarily carries with it careful study of the economical use of fuel in the iron and steel works. In 1928 he was presented by the Iron and Steel Institute in this country with the Bessemer Medal.

Mr. Schwab was born in Williamsburg, Blair County, Pa., U.S.A., on February 18, 1862. In 1881 he secured a position in the engineering department of the Edgar Thomson Works of the Carnegie Steel Company, rising to the position of chief of the engineering department and principal assistant to Captain William Jones, the manager of the works. Upon the death of Captain Jones, he became superintendent of the Edgar Thomson Works, and, in 1892, of the Homestead Works, having been largely responsible for the redesigning and reconstruction of that works after its acquisition by the Carnegie Co. In 1896 he became a member of the board of managers of the Carnegie Steel Co., and the following year was elected its president. He developed commercial ability and vision of the highest rank, which resulted finally in attracting strong financial interests, headed by the late J. P. Morgan, and brought about the formation of the United States Steel Corporation in 1901, of which Mr. Schwab became the first president at 39 years of age. He resigned this position in 1904 and acquired a controlling ownership in the Bethlehem Steel Co. His development of this company to its present rank, as the second largest steel producer in the United States, is a tribute to his engineering technical and organising ability.

Manufacture of Manganese Dioxide

New Electrolytic Method

THE production of manganese dioxide of 92 to 100 per cent. purity by electrolysis of manganese nitrate is of interest in connection with the growing demand for the pure substance in the manufacture of dry cells. Using platinum electrodes and a bath temperature of 40° C., Kameyama and Ilida ("J. Soc. Chem. Ind. Japan," August 1932, p. 374) have obtained the most favourable results when a current of 10 amperes per square centimetre was passed through a solution of manganese nitrate containing a 3 per cent. manganese ion concentration and a 2 to 3 per cent. acidity (nitric acid). The manganese dioxide, which settles to the bottom of the vessel, is finally dried at 200° to 300° C.

Lead Soldering

Elimination of Poisoning Danger

LEAD monoxide in the form of a very fine mist is produced during lead soldering operations, the risk of inhalation by the workers being intensified by the slow rate at which the oxide settles to the ground. It has recently been shown by Engel and Forboese ("Arch. Hygiene," *90*, 69-101) that oxide formation takes place on a far smaller scale if carbon-containing flames are used in place of the oxy-hydrogen flame, so far as practicable. Oxy-acetylene and oxy-coal gas are suggested as convenient substitutes. It has elsewhere been suggested that a readily volatile lead hydride might be produced during soldering operations, but no trace of such a compound could be detected during the investigation.

Changes in Vulcanised Rubber

Heat Investigations at the Bureau of Standards

WHEN raw rubber is heated with sulphur, it undergoes a marked change in properties and forms what is commonly known as vulcanised rubber. The amount of sulphur combined with the rubber may range from a fraction of one per cent. to about 32 per cent. The products containing the lower percentages of sulphur are soft and occur in familiar articles such as automobile tyres and many household rubber goods. The ordinary hard rubber is an example of a compound containing the higher percentages of sulphur. Such vulcanised rubber is used commercially in many articles, such as gaskets, steam hose, and brake lining, which are subjected to relatively high temperatures.

When vulcanised rubber is heated, it gives rise to an unpleasant odour which becomes more intense and more disagreeable the higher the temperature. The odour is due in large part to sulphur compounds which are derived from the sulphur that was used to vulcanise the rubber. This loss of sulphur is accompanied in general by deterioration in the electrical and mechanical properties of the rubber. A study has therefore been made at the United States Bureau of Standards to ascertain the extent to which rubber of various composition decomposes on heating. The purpose of the investigation was to determine to what temperature and for what length of time vulcanised rubber could be heated without producing a serious change in the composition.

In this study, measurements were made of the principal product of decomposition, hydrogen sulphide. Below the temperature of boiling water the rate of decomposition was so slow that no significant portion of the sulphur content was lost. As the temperature was increased, however, the rate of evolution of hydrogen sulphide increased rapidly. Hard rubber, vulcanised with about one-third its weight of sulphur, lost hydrogen sulphide much more rapidly than did soft rubber vulcanised with only a fraction as much sulphur. After 24 hours' heating at 430° F., hard rubber lost about one-third of its sulphur content and changed to a brittle, translucent, reddish-brown material. The results of the investigation afford fundamental data from which it is possible to determine how much a sample of rubber will decompose when the composition of the rubber and the time and temperature are given. An account of the work will be found in the "Bureau of Standards Journal of Research" for August, 1932.

German Lithopone Trade

Effect of British Duty

THE largest producer of lithopone in Germany is Sachtleben A.G. fur Bergbau and Chemische Industrie, of Cologne, whose output of the pigment fell from 21,619 metric tons in 1930 to 20,430 tons during 1931. The firm has a capital of 12,500,000 marks and paid 10 per cent. dividend on net profits of 1,377,000 marks last year, against 12 per cent. dividend on 1,526,000 marks net in 1930. Sachteben is associated with the German I.G. and both are members of the Sales Cartel Lithopone Kontor G.m.b.H. of Leverkusen, which is composed of the leading German lithopone producers. Export trade of lithopone was critically affected in 1931 mainly by a new 50 per cent. duty levied by Great Britain. The trade lost is estimated at 20,000 metric tons.

The Heating of Asphalt

Use of Diphenyl Vapour

HEATING asphalt with diphenyl vapour is the subject of Engineering Research Bulletin No. 23, published by the University of Michigan. This bulletin describes experimental work carried out to determine the characteristics of a method of heating asphalt that uses condensing diphenyl vapour as a source of heat. A single-tube semi-commercial scale heater was constructed and heated with condensing diphenyl. Forced asphalt circulation was used. It was found that the asphalt was heated at a very satisfactory rate and under such accurate temperature control that even under extreme conditions no damage was done to the asphalt. Heat transfer coefficients on both the diphenyl side and on the asphalt side were determined over a wide range of operating conditions. Over-all coefficients of 32 to 42 B.Th. U. per sq. ft. per hour per °F. were obtained. The asphalt-film coefficients varied from 35 to 50 B.Th.U. per sq. ft. per hour per °F. and diphenyl coefficients from 250 to 350 B.Th.U. per sq. ft. per hour per °F. No mechanical difficulties appeared that were not readily solved on the scale in which the experiments were conducted. As an outcome of this work, new data were obtained on the effect of heat on the density, penetration, softening point, and viscosity of asphalt.

Coal, Cellulose Fibre and Wood

Details of Physical Structure

THE physical structures of cellulose fibre, wood, and coal as seen by the Spierer lens are described and shown by photographs reproduced in the September issue of "Industrial and Engineering Chemistry." An attempt has been made to correlate the observations thus made with the structure of the same substances as determined by X-ray methods. The author of this article, Dr. R. Thiessen, Pittsburgh Experiment Station, United States Bureau of Mines, has not tried to interpret in all cases what the Spierer lens reveals, or to reconcile the Spierer pictures not in accord with those constructed after X-ray diffractions.

That coal is a colloid has been generally accepted for some time. Investigations by means of new methods by vertical illumination, particularly as used in the Spierer lens, not only give conclusive evidence of the colloidal nature of coal but also show the arrangement and the side of the micelles in coal. The micelle arrangement in coal, as far as preserved, is similar to that of the plant tissues from which the coal was derived. The micelle structure of plant tissues is clearly shown and no longer leaves any doubt that wood fibres or cellulose fibres, as in cotton and ramie, are definitely built up of micelles in characteristic arrangement, and verify the Nägeli micelle theory and the structure postulated by X-ray methods. In semi-rotten wood the individual micelles are similar in arrangement, but stand out more clearly than in sound wood; in wood in a more advanced stage of decay, the micelles stand out still more clearly, yet their original arrangement has been retained. Transition stages from sound wood to well-rotted wood indicate that there is a close relationship between cellulose and lignin in wood. In the woody derivatives of brown coal, lignite, and sub-bituminous coal, the original arrangement is unmistakably shown.

News from the Allied Industries

Iron and Steel

THE FIRST OPEN-HEARTH FURNACE of the great Stalin metallurgical plant at Kuznetsk in Siberia has begun smelting steel. Three more open-hearth furnaces are under construction and the plant, when completed, will include fifteen open-hearth furnaces with a yearly output of 1,450,000 tons of steel.

Artificial Silk

RUMOURS have been in circulation on the Brussels Bourse to the effect that shareholders in the Tubize Artificial Silk Works would shortly receive details of a reconstruction scheme. In March of this year Tubize joined with four other leading Belgian rayon manufacturers in L'Union des Fabriques Belges de Textiles Artificiels, usually known as Fabelta. The companies involved pooled their viscose production and sales organisation, but continued independent as far as their other products were concerned. Thus, Tubize did not include its acetate (setilose) business in the union. The constituent companies were to share in the capital of Fabelta according to the contribution of each. This contribution was not precisely determined at the time, but was to be assessed by an expert committee.

China Clay

THE CHINA CLAY SHIPMENTS for August showed an improvement compared with the previous month, the increased tonnage being 5,305 tons. China stone has also improved its output compared with July. The returns make a total of 47,315 tons china clay, 2,740 tons of china stone, 867 tons of ball clay—against 43,163 tons of china clay, 1,545 tons of china stone, and 909 tons of ball clay in July.

MR. E. BEVIN, the general secretary of the Transport and General Workers' Union, addressed a demonstration of china clay workers at St. Austell on September 17, when he emphasised the point that no member of Parliament had said one word about the china clay trade in Cornwall. The employers in that industry were wrong to stand idly by and let the industry go to ruin. The Union was going to approach the employers and he hoped their reply would be of an intelligent character whatever the conditions might be of wages and hours. Major Attlee, deputy leader of the Labour party, also addressed the gathering and criticised the Government's tariff policy.

Calico Printing and Bleaching

A SUBSTANTIAL REDUCTION IN THE CHARGES for bleaching cotton cloths is announced by the Bleaching Trade Advisory Board, and as a result of the lower rates a big fillip is expected to be given to trade in all kinds of bleaching cloths. The reduction, which came into operation this week, means that the 5 per cent. surcharge is removed, and with regard to shirtings a further 5 per cent. reduction is made. This means that on an ordinary standard white shirting the bleaching cost is reduced by 3d. to 1½d. per piece. There is also a reduction in the charges for bleaching mulls of 15 per cent., which means that the cost will now be 7d. per piece, against 8d.

THE RESULTS OF THE OTTAWA CONFERENCE were criticised by Mr. Lennox B. Lee, chairman of the Calico Printers' Association, Ltd., at the annual meeting held in Manchester on September 14. Although it was perhaps too early to form a definite opinion as to the ultimate result of the Ottawa negotiations, Mr. Lee said, it seemed clear that, so far as a general lowering of tariffs and freer trade were concerned, we were no nearer our objective. On the contrary, in return for vague and somewhat indefinite undertakings on the part of the Dominions, our negotiations have committed us for at least five years to a policy of preferential tariffs covering a wide range of commodities, and restraint is to be placed upon our trade with the rest of the world. The effect must be ultimately to increase our costs of production. If the development and extension of our trade depends upon reciprocal tariff agreements, said Mr. Lee, then, in considering the needs of the Empire, our relationship to the world as a whole must not be overlooked.

Shale Oil

MR. WALTER NELLIESON, organising secretary, on behalf of the executive council of the National Union of Shale Miners and Oil Workers, has asked the oil companies for a 10 per cent. advance in the current rate of wages in view of the increased prices for petrol. A conference with the companies' representatives is suggested.

Mineral Oil

A GROUP OF FRENCH IMPORTERS, headed by the "Petrofina Française," is understood to have signed a contract with the Union Oil Export Co. for the supply of two million tons of oil products during the five years ending August 31, 1937.

GEOLOGISTS AND ENGINEERS have arrived at Wellington, New Zealand, from the United States to conduct a survey of oil areas as a result of the recent agreement between the Taranaki Oilfields, Ltd., and the Vacuum Oil Company of America.

INDEPENDENT OIL INDUSTRIES, LTD., will shortly be registered to market high-grade Roumanian petrol at low prices in Australia. The first shipment of 2,000,000 gallons is arriving in the tanker "Woendrecht," to be retailed at 1s. 9d. per gallon.

THE IRAQ PETROLEUM CO. is planning to export 4,000,000 tons of oil annually from the Iraq oilfields so soon as the pipe-line to the sea has been completed, according to Thabit Abdunnoor Bey, the Iraq Government Director for Oilfields, who has arrived in London from Baghdad on a prolonged tour of oilfields and oil-producing countries. It is reported that this amount will be divided among the four main groups that comprise the Iraq Petroleum Co., namely, the Anglo-Persian Oil Co., Royal Dutch-Shell, and the American and French groups.

REPORTS OF AN ARRANGEMENT by which Canadian aluminium, wire and cable to the value of £250,000 will be exchanged for Russian crude petroleum of the same value has been confirmed by the Aluminium Company of Canada, which is controlled by the Aluminium, Ltd. (United States), Corporation. This arrangement is regarded as significant of the probable policy of the Soviet in further international exchange negotiations on a similar basis. Canada has placed an embargo on Soviet imports of coal, pulpwood, pulp, timber, asbestos and furs, but so far not on oil, although the Soviet has hitherto put an embargo on all Canadian imports.

Production of Oil from Coal

Development of the Salerni Process

LADY HOUSTON is reported to be actively associated with Sir Eric Hambro in providing funds for the development of the Salerni coal refining process, and it is anticipated that the process will be in full use in this country by next March. At the Bituminous Coal Conference at Pittsburgh last year, Professor R. V. Wheeler, of Sheffield, stated that the Salerni process of low temperature coal carbonisation had solved a problem that had long baffled investigators.

Sir Eric Hambro purchased the whole of the rights of the process in the United Kingdom, and following the experimental work which has been done, it is now his attention to develop a plant on a commercial scale on a site not yet selected, although it is understood that it will be in a coal-producing area. Designs and particulars of the process have been thoroughly examined by experts, and tenders for the manufacture of the plant have been invited from various North of England firms, including some in South Yorkshire. The company promoting the system, with Sir Eric as chairman, is the British Coal Refining Processes, Ltd., and among the consultants are Professor Wheeler and Commendatore Salerni.

Sir Eric Hambro claims that the Salerni process "at last makes it possible to find a market for small coal, while the production of oil of the requisite quality will make us less dependent on foreign suppliers. It has long been recognised by all the mining authorities in the world that an effective system of low temperature carbonisation would solve mining difficulties."

Weekly Prices of British Chemical Products

Review of Current Market Conditions

The following notes on the chemical market conditions in Great Britain are based on direct information supplied by the British manufacturers concerned, and unless otherwise qualified the figures quoted apply to fair quantities, net and naked at makers' works. Where no locality is indicated, the prices are general for the United Kingdom. Particulars of the London chemical market are specially supplied to THE CHEMICAL AGE by R. W. Greeff and Co., Ltd., and Chas. Page and Co., Ltd., and those of the Scottish chemical market by Chas. Tennant and Co., Ltd.

THERE is very little change to report in the London chemical market, the demand for most products being moderate and prices on the whole firm. Coal tar products remained unchanged from last week, except in the case of motor benzol and solvent naphtha, which have increased in price by 2d. per gal., owing to the rise in petrol. A moderate inquiry has been reported during the week on the Manchester chemical market in respect of some of the principal lines of products, but in view of the prevailing conditions in this part of the country there is still little disposition on the part of consumers to move far forward. There is a feeling that the cotton trade stoppage may come to an end this week, and if this occurs a freer flow of chemicals should result. Under the circumstances, delivery specifications against orders already placed are not unsatisfactory. Except for continued uncertainty in one or two directions the market generally remains steady. Business in the Scottish market has shown a slight improvement during the week, with an increase in export inquiries.

General Chemicals

ACETONE.—LONDON: £65 to £68 per ton; SCOTLAND: £66 to £68 ex wharf, according to quantity.

ACID, ACETIC.—Tech. 80%, £37 5s. to £39 5s.; pure 80% £38 5s. to £40 5s.; tech., 40%, £19 15s. to £21 15s.; tech., 60%, £28 10s. to £30 10s. SCOTLAND: Glacial 98/100%, £48 to £50; pure 80%, £38 5s.; tech. 80%, £37 5s. d/d buyers' premises Great Britain. MANCHESTER: 80%, commercial, £39; tech. glacial, £52.

ACID, BORIC.—SCOTLAND: Granulated commercial, £26 10s. per ton; B.P. crystals, £35 10s.; B.P. powder, £36 10s. in 1-cwt. bags d/d free Great Britain in one-ton lots upwards.

ACID, CHROMIC.—11d. per lb., less 2½%, d/d U.K.

ACID, CITRIC.—1s. 0½d. per lb. LONDON: 11½d. less 5%. MANCHESTER: 10½d. to 10¾d.

ACID, CRESYLIC.—97/99%, 1s. 5d. to 1s. 7d. per gal.; 99/100%, 1s. 9d. to 2s.

ACID FORMIC.—London: £48 per ton.

ACID, HYDROCHLORIC.—Spot, 3s. 9d. to 6s. carboy d/d according to purity, strength and locality. SCOTLAND: Arsenical quality, 4s.; dearsenicated, 5s. ex works, full wagon loads.

ACID, LACTIC.—LANCASHIRE: Dark tech., 50% by vol., £24 10s per ton; 50% by weight, £28 10s.; pale tech., 50% by vol., £28; 50% by weight, £33; 80% by weight, £53; edible, 50% by vol., £41. One-ton lots ex works, barrels free.

ACID, NITRIC.—80° Tw. spot, £220 to £25 per ton makers' works, according to district and quality. SCOTLAND: 80°, £23 ex station full truck loads.

ACID, OXALIC.—LONDON: £45 10s. per ton in casks, £48 10s. to £52 10s. in kegs. SCOTLAND: 98/100%, £49 to £52 ex store. MANCHESTER: £46, ex store.

ACID, SULPHURIC.—Average prices f.o.r. British makers' works, with slight variations owing to local considerations: 140° Tw. crude acid, £3 per ton; 168° Tw. arsenical £5 10s.; 168° Tw. non-arsenical, £6 15s. SCOTLAND: 144° quality, £3 12s. 6d.; 168°, £7; dearsenicated, 20s. per ton extra.

ACID, TARTARIC.—11½d. per lb. SCOTLAND: B.P. crystals, 11½d. to 1s., less 5%, carriage paid. MANCHESTER: 11d.

ALUM.—SCOTLAND: Lump potash, £9 per ton ex store.

ALUMINA SULPHATE.—LONDON: £8 5s. to £9 10s. per ton. SCOTLAND: £8 to £8 10s. ex store.

AMMONIA, ANHYDROUS.—Spot, 10d. per lb. d/d in cylinders. SCOTLAND: 10d. to 1s. containers extra and returnable.

AMMONIA LIQUID.—SCOTLAND: 80°, 2½d. to 3d. per lb. d/d.

AMMONIUM BICHROMATE.—8d. per lb. d/d U.K.

AMMONIUM CARBONATE.—SCOTLAND: Lump, £36 per ton; powdered, £38, in 5-cwt. casks d/d U.K. stations or f.o.b. U.K. ports.

AMMONIUM CHLORIDE.—£37 to £45 per ton, carriage paid. LONDON: Fine white crystals, £19 to £20. (See also Salammoniac.)

AMMONIUM CHLORIDE (MURIATE).—SCOTLAND: British dog tooth crystals, £32 to £35 per ton carriage paid according to quantity. (See also Salammoniac.)

ANTIMONY OXIDE.—SCOTLAND: Spot, £22 per ton, c.i.f. U.K. ports.

ANTIMONY SULPHIDE.—Golden 6½d. to 1s. 1½d. per lb.; crimson, 1s. 4d. to 1s. 6d. per lb. according to quality.

ARSENIC.—LONDON: £24 10s. c.i.f. main U.K. ports for imported material; Cornish, nominal, £26 f.o.r. mines. SCOTLAND: White powdered £27 ex wharf; spot, £27 10s. ex store. MANCHESTER: White powdered Cornish, £25 10s. at mines.

ARSENIC SULPHIDE.—Yellow 1s. 6d. to 1s. 8d. per lb.

BARIUM CHLORIDE.—£11 per ton.

BISULPHITE OF LIME.—£7 10s. per ton f.o.r. London, packages free.

BLEACHING POWDER.—Spot 35/37% £7 19s. per ton d/d station in casks, special terms for contract. SCOTLAND: £8 15s. in 5/6 cwt. casks.

BORAX, COMMERCIAL.—Granulated £15 10s. per ton, power £17, packed in 1-cwt. bags, carriage paid any station Great Britain. Prices are for 1-ton lots and upwards.

CADMIUM SULPHIDE.—3s. 4d. to 3s. 7d. per lb.

CALCIUM CHLORIDE.—Solid 70/75% spot £5 5s. to £5 15s. per ton d/d station in drums.

CARBON BISULPHIDE.—£30 to £32 per ton, drums extra.

CARBON BLACK.—4½d. to 5⅞d. per lb., ex wharf.

CARBON TETRACHLORIDE.—£45 to £55 per ton, drums extra.

CHROMIUM OXIDE.—10d. to 10½d. per lb. according to quantity d/d U.K. Green 1s. 2d. per lb.

CHROMETAN.—Crystals 3¾d. per lb. Liquor £19 10s. per ton d/d.

COPPERAS (GREEN).—SCOTLAND: £3 15s. per ton, f.o.r, or ex works.

CREAM OF TARTAR.—LONDON: £4 5s. per cwt.

FORMALDEHYDE.—LONDON: £28 per ton. SCOTLAND: 40%, £28 ex store.

LAMPBLACK.—£46 to £50 per ton.

LEAD ACETATE.—LONDON: White, £34 per ton. Brown, £1 per ton less. SCOTLAND: White Crystals £40 to £41 c.i.f. U.K. ports. Brown, £1 per ton less. MANCHESTER: White, £32 10s.; Brown, £31.

LEAD NITRATE.—£28 per ton. MANCHESTER: £28.

LEAD, RED.—SCOTLAND: £28 10s. per ton d/d buyer's works.

LEAD, WHITE.—SCOTLAND: £40 per ton carriage paid.

LITHOPONE.—30%, £19 to £21 per ton.

MAGNESITE.—SCOTLAND: Ground Calcined £9 per ton ex store.

METHYLATED SPIRIT.—61 O.P. Industrial 1s. 8d. to 2s. 3d. gal. Pyridinised Industrial, 1s. 10d. to 2s. 5d. Mineralised, 2s. 9d. to 3s. 3d. 64 O.P. 1d. extra in all cases. Prices according to quantities. SCOTLAND: Industrial 64 O.P., 1s. 9d. to 2s. 4d.

NICKEL AMMONIUM SULPHATE.—£52 per ton d/d.

NICKEL SULPHATE.—£52 per ton d/d.

PHENOL.—Small lots 6¼d. to 6½d. per lb. in 3-cwt. drums, bulk quantities down to 5½d. per lb., delivery free U.K.

POTASH, CAUSTIC.—LONDON: £42. MANCHESTER: £39 to £40.

POTASSIUM BICHROMATE.—Crystals and Granular, 5d. per lb. net d/d U.K. Discount according to quantity. Ground 5¾d. LONDON: 5d. per lb. with usual discounts for contracts. SCOTLAND: 5d. d/d U.K. or c.i.f. Irish Ports. MANCHESTER: 5d.

POTASSIUM CARBONATE.—SCOTLAND: 96/98% spot £28 per ton ex store. LONDON: £31 10s. to £32. MANCHESTER: £29 to £30.

POTASSIUM CHLORATE.—3¾d. per lb. ex wharf London in 1-cwt. kegs. LONDON: £37 to £40 per ton. SCOTLAND: 99¾/100% powder, £34. MANCHESTER: £37.

POTASSIUM CHROMATE.—6½d. per lb. d/d U.K.

POTASSIUM NITRATE.—SCOTLAND: Refined Granulated £29 per ton c.i.f. U.K. ports. Spot £30 per ton ex store.

POTASSIUM PERMANGANATE.—LONDON: 8½d. per lb. SCOTLAND: B.P. crystals, 8½d. MANCHESTER: Commercial, 8¼d.; B.P., 9d.

POTASSIUM PRUSSIATE.—LONDON: 8½d. to 9d. per lb. SCOTLAND: Yellow spot material, 8½d. ex store. MANCHESTER: Yellow, 8¼d.

SALAMMONIAC.—First lump spot, £42 17s. 6d. per ton d/d in barrels.

SODA ASH.—58% spot, £6 per ton f.o.r in bags, special terms for contracts.

SODA, CAUSTIC.—Solid 76/77° spot, £14 10s. per ton d/d station. SCOTLAND: Powdered 98/99%, £17 10s. in drums £18 15s. in casks. Solid 76/77% £14 10s. in drums 70/72% £14 12s. 6d., carriage paid buyer's station, minimum 4-ton lots; contracts 10s. per ton less. MANCHESTER: £12 15s. to £14 10s. contracts.

SODA CRYSTALS.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.

SODIUM ACETATE.—£21 to £22 per ton.

SODIUM BICARBONATE.—Refined spot, £10 10s. per ton d/d station in bags. SCOTLAND: Refined recrystallised £10 10s. ex quay or station. MANCHESTER: £10 10s.

SODIUM BICHROMATE.—Crystals cake and powder 4d. per lb. net d/d U.K. discount according to quantity. Anhydrous 5d. per lb. LONDON: 4d. per lb. with discounts for quantities. SCOTLAND: 4d. delivered buyer's premises with concession for contracts. MANCHESTER: 4d. less 1 to 3½% contracts, 4d. spot lots.

SODIUM BISULPHITE POWDER.—60/62%, £16 10s. per ton d/d/ 1-cwt. iron drums for home trade.

SODIUM CARBONATE (SODA CRYSTALS).—SCOTLAND: £5 to £5 5s. per ton ex quay or station. Powdered or pea quality 7s. 6d. per ton extra. Light Soda Ash £7 ex quay, min. 4-ton lots with reductions for contracts.

SODIUM CHLORATE.—2¾d. per lb. LONDON: £29 per ton. MANCHESTER: £29 10s.

SODIUM CHROMATE.—3⅜d. per lb. d/d U.K.

SODIUM HYPOSULPHITE.—SCOTLAND: Large crystals English manufacture, £9 5s. per ton ex stations, min. 4-ton lots. Pea crystals £15 ex station 4-ton lots. MANCHESTER: Commercial, £9 5s.; photographic, £15.

SODIUM NITRITE.—Spot, £19 to £22 per ton d/d station in drums.

SODIUM PERBORATE.—LONDON: 10d. per lb.

SODIUM PHOSPHATE.—£13 to £15 per ton.

SODIUM PRUSSIATE.—LONDON: 5d. to 5½d. per lb. SCOTLAND: 5d. to 5¾d. ex store. MANCHESTER: 5d. to 6d.

SODIUM SILICATE.—140° Tw. Spot £8 5s. per ton d/d station returnable drums.

SODIUM SULPHATE (GLAUBER SALTS).—£4 2s. 6d. per ton d/d. SCOTLAND: English material £3 15s.

SODIUM SULPHATE (SALT CAKE).—Unground Spot £3 15s. per ton d/d station in bulk. SCOTLAND: Ground quality, £3 5s. per ton d/d. MANCHESTER: £3 2s. 6d.

SODIUM SULPHIDE.—Solid 60/62% Spot, £10 15s. per ton d/d in drums. Crystals Spot £7 15s. per ton d/d in casks. SCOTLAND: For home consumption, Solid 60/62%, £10 5s.; broken 60/62%, £11 5s.; crystals, 30/32%, £8 2s. 6d. d/d buyer's works on contract, min. 4-ton lots. Spot solid 5s. per ton extra. Crystals, 2s. 6d. per ton extra. MANCHESTER: Concentrated solid, 60/62%, £11 10s.; commercial, £8.

SODIUM SULPHITE.—Pea crystals spot, £13 10s. per ton d/d station in kegs. Commercial spot £9 10s. d/d station in bags.

SULPHATE OF COPPER.—MANCHESTER: £16 10s. to £17 per ton f.o.b.

SULPHUR.—£12 per ton. SCOTLAND: Flowers, £12 10s.; roll, £12; rock, £9. Ground American, £12 ex store.

SULPHUR CHLORIDE.—5d. to 7d. per lb., according to quality.

SULPHUR PRECIP.—B.P. £55 to £60 per ton according to quantity. Commercial, £50 to £55.

VERMILION.—Pale or deep, 4s. 6d. to 4s. 11d. per lb.

ZINC CHLORIDE.—SCOTLAND: British material, 98%, £18 10s. per ton f.o.b. U.K. ports.

ZINC SULPHATE.—LONDON and SCOTLAND: £12 per ton.

ZINC SULPHIDE.—1s. to 1s. 2d. per lb.

Pharmaceutical and Fine Chemicals

ACID, TARTARIC.—10¾d. per lb.

BISMUTH SALTS.—Carbonate, 6s. 6d. per lb.; citrate, 8s. 10d.; nitrate (cryst.), 4s. 4d.; oxide, 10s.; salicylate, 7s. 3d.; subchloride, 9s. 10d.; subgallate, 6s. 11d.; subnitrate, 5s. 8d.

PHENOLPHTHALEIN.—4s. to 5s. per lb.

POTASSIUM BITARTRATE, 99/100% (Cream of Tartar).—£4 5s. per cwt

SODIUM BENZOATE, B.P.—1s. 7d. per lb.

SODIUM CITRATE, B.P.C. 1911.—1s. 3d. per lb.; B.P.C. 1923 and U.S.P., 1s 7d per lb.

VANILLAN.—Ex clove oil, 16s. to 18s. per lb. Ex Guaiacol, 14s. 3d. to 16s. 3d. per lb., including packing and delivery free U.K.

Essential Oils

ALMOND, FOREIGN, S.P.A.—11s. 6d. per lb.

ANISE.—2s. per lb.

BERGAMOT.—11s. per lb.

BOURBON GERANIUM.—26s. 6d. per lb.

CAMPHOR, WHITE.—£4 15s. per cwt.

CITRONELLA OIL, JAVA.—3s. 3d. per lb.

LEMON.—6s. per lb.

LEMONGRASS.—2s. 3d. per lb.

PEPPERMINT, JAPANESE.—4s. per lb.

PETITGRAIN.—5s. 6d. per lb.

Intermediates and Dyes

IN the following list of Intermediates delivered prices include packages except where otherwise stated:—

ACID, BENZOIC, B.P. (ex Toluol).—1s. 9½d. per lb.

ACID, GAMMA.—Spot, 4s. per lb. 100% d/d buyer's works.

ACID, H.—Spot, 2s. 4½d. per lb. 100% d/d buyer's works.

ACID, NEVILLE AND WINTHER.—Spot, 3s. per lb. 100% d/d buyer's works.

ACID, SULPHANILIC.—Spot, 8d. per lb. 100% d/d buyer's works.

ANILINE OIL.—Spot, 8d. per lb., drums extra, d/d buyer's works.

ANILINE SALTS.—Spot, 8d. per lb. d/d buyer's works, casks free.

BENZALDEHYDE.—Spot, 1s. 8d. per lb., packages extra.

BENZIDINE BASE.—Spot, 2s. 5d. per lb. 100% d/d buyer's works.

o-CRESOL 30/31° C.—£2 6s. 5d. per cwt., in 1-ton lots.

m-CRESOL 98/100%.—2s. 9d. per lb., in ton lots.

p-CRESOL 34.5° C.—1s. 9d. per lb., in ton lots.

DICHLORANILINE.—2s. per lb.

DIMETHYLANILINE.—Spot, 1s. 6d. per lb., package extra.

DINITROBENZENE.—8½d. per lb.

DINITROTOLUENE.—48/50° C., 8¼d. per lb.; 66/68° C., 9d. per lb.

DIPHENYLAMINE.—Spot, 2s. per lb., d/d buyer's works.

α-NAPHTHOL.—Spot, 2s. 4d. per lb., d/d buyer's works.

β-NAPHTHOL.—Spot, £75 per ton in 1-ton lots, d/d buyer's works.

α-NAPHTHYLAMINE.—Spot, 11½d. per lb., d/d buyer's works.

β-NAPHTHYLAMINE.—Spot, 2s. 9d. per lb. d/d buyer's works.

o-NITRANILINE.—5s. 10d. per lb.

m-NITRANILINE.—Spot, 2s. 7d. per lb. d/d buyer's works.

p-NITRANILINE.—Spot, 1s. 8d. per lb. d/d buyer's works.

NITROBENZENE.—Spot, 5d. per lb.; 5-cwt. lots, drums extra.

NITRONAPHTHALENE.—9d. per lb.

SODIUM NAPHTHIONATE.—Spot, 1s. 9d. per lb.

o-TOLUIDINE.—Spot, 9½d. per lb., drums extra, d/d buyer's works.

p-TOLUIDINE.—Spot, 1s. 11d. per lb., d/d buyer's works.

m-XYLIDINE ACETATE.—3s. 6d. per lb., 100%.

Coal Tar Products

ACID, CARBOLIC (CRYSTALS).—5½d. to 6¾d. per lb. Crude, 60's 1s. 5¼d. to 1s. 6¼d. per gal. SCOTLAND: Sixties, 1s. 7d. to 1s. 8d.

ACID, CRESYLIC.—99/100, 1s. 7d. per gal.; B.P., 1s. 10d. to 2s.; Refined, 1s 8d. to 1s. 10d.; Pale, 98%, 1s. 6d. to 1s. 7d.; Dark, 1s. 3d. to 1s. 4d. LONDON: 98/100%, 1s 6d. Dark 95/97%, 1s. 4d. SCOTLAND: Pale 99/100%, 1s. 3d. to 1s. 4d.; 97/99%, 1s. to 1s. 1d.; dark 97/99%, 11d. to 1s.; high boiling acid, 2s. 6d. to 3s.

BENZOL.—At works, crude, 10d. to 11d. per gal.; standard motor, 1s. 6½d. to 1s. 7d.; 90%, 1s. 7d. to 1s. 8d.; pure, 1s. 10d. to 1s. 11d. LONDON: Motor, 1s. 7½d. SCOTLAND: Motor, 1s. 6½d. to 1s. 7½d.; 90%, 2s. 0½d. to 2s. 1½d.

CREOSOTE.—Standard for export, 4¾d. to 5d. nett per gal. f.o.b. for Home, 3¾d. d/d. LONDON: 3d. to 3½d. f.o.r. North; 4d. to 4½d. London. MANCHESTER: 3d. to 4d. SCOTLAND: Specification oils, 3¾d to 4¼d.; washed oil, 4d. to 4½d.; light, 3¾d. to 4¼d.; heavy, 4½d. to 5d.

NAPHTHA.—Solvent, 90/160, 1s. 4d. to 1s. 5d. per gal.; 95/160, 1s. 8d.; 90/190, 1s. 1d. to 1s. 2d. LONDON: Solvent, 1s. 3½d. to 1s. 4d.; heavy, 11d. to 1s. 0½d. f.o.r SCOTLAND: 90/160, 1s. 3d. to 1s. 3½d.; 90/190, 1s. 1d. to 1s. 2d.

NAPHTHALENE.—Purified crystals, £9 10s. per ton in bags. LONDON: Fire lighter quality, £3 to £3 10s.; 74/76 quality, £4 to £4 10s.; 76/78 quality, £5 10s. to £6. SCOTLAND: 40s. to 50s.; whizzed, 65s. to 70s.

PITCH.—Medium soft, £4 7s. 6d. to £5 per ton.

PYRIDINE.—90/140, 3s. 9d. per gal.; 90/160, 4s. to 4s. 6d.; 90/180, 2s. to 2s. 6d. SCOTLAND: 90/160%, 4s. to 5s.; 90/220%, 3s. to 4s.

REFINED COAL TAR.—SCOTLAND: 4¾d. to 5d. per gal.

XYLOL.—2s. per gal.; Pure, 2s. 2d.

Wood Distillation Products

ACETATE OF LIME.—Brown, £8 10s. per ton. Grey, £10 10s. to £12. Liquor, brown, 30° Tw., 6d. per gal. MANCHESTER: Brown, £8 10s.; grey, £11 5s.

ACETIC ACID, TECHNICAL, 40%.—£16 10s. to £18 10s. per ton.

AMYL ACETATE, TECHNICAL.—95s. to 110s. per cwt.

CHARCOAL.—£6 10s. to £11 per ton.

WOOD CREOSOTE.—6d. to 2s. per gal., unrefined.

WOOD NAPHTHA, MISCIBLE.—2s. 6d. to 4s. per gal. Solvent, 3s. 9d. to 4s. 9d. per gal.

WOOD TAR.—£2 to £6 per ton.

Nitrogen Fertilisers

SULPHATE OF AMMONIA.—The export market remains firm and the price is unchanged at £4 10s. per ton for prompt shipment f.o.b. U.K. port in single bags. For October the price is 2s. 6d. per ton higher. The home market continues quiet at £5 5s. per ton delivered in 6-ton lots to farmers' nearest station. It is understood that a great number of merchants have covered their requirements for the season at this price.

NITRATE OF SODA.—There has been no change in the prices reported in our last issue.

NITRO-CHALK.—The price remains unchanged at £7 5s. per ton, delivered in 6-ton lots.

Latest Oil Prices

LONDON, Sept. 21.—LINSEED OIL was very firm. Spot small quantities, £19 10s.; Oct., £17 5s.; Oct.-Dec., £17 12s. 6d.; Jan.-April, £18 10s.; May-Aug., £19 10s. per ton, naked. RAPE OIL was quiet. Crude, extracted, £29; technical, refined, £31 per ton, naked, ex wharf. COTTON OIL was steady; Egyptian, crude, £23 10s.; refined common edible, £26 10s. and deodorised, £28 10s. per ton, naked, ex mill. TURPENTINE was firm. American, spot, 64s. per cwt.

HULL.—LINSEED OIL, spot, closed at £17 per ton; Sept., £16 15s. Oct.-Dec., £17 2s. 6d.; Jan.-April, £18 2s. 6d.; May-Aug., £19 2s. 6d. COTTON OIL, Egyptian, crude, spot, £24; edible, refined, spot, £26 10s.; technical, spot, £26 10s.; deodorised, £27 10s., naked. PALM KERNEL OIL, crude, f.m.q., spot, £22 10s., naked. GROUNDNUT OIL, crushed/extracted, spot, £31 10s.; deodorised, £35 10s. RAPE OIL, crushed/extracted, spot, £28 10s.; refined, £30. SOYA OIL, crushed/extracted, spot, £23 10s.; deodorised, £26 10s. per ton. COD OIL, 15s. 6d. per cwt. TURPENTINE, American, spot, 66s. per cwt. CASTOR OIL, pharmacy, spot, 42s.; first, 37s.; second, 38s. per cwt.

Inventions in the Chemical Industry

Specifications Accepted and Applications for Patents

THE following information is prepared from the Official Patents Journal. Printed copies of Specifications Accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Specifications Accepted with Dates of Applications

TREATMENT OF ORGANIC SUBSTANCES WITH SULPHURISING AGENTS. J. Y. Johnson (*I. G. Farbenindustrie*). April 27, 1931. 380,082.

PROCESS FOR PRODUCING COMPLEX METAL COMPOUNDS OF PYRIDINE CARBOXYLIC ACIDS CONTAINING ONE OR MORE SULPHHYDRYL RESIDUES. Dr. A. Rothmann. May 5, 1931. 380,083.

PRODUCTION OF STABLE EMULSIONS AND SUSPENSIONS. Erba Fabrik Chemischer Produkte Spezialitaten fur Die Textilindustrie. Jan. 12, 1931. 380,052.

MANUFACTURE OF TRANSPARENT FOILS, FILMS, WRAPPING MATERIALS, AND THE LIKE FROM REGENERATED CELLULOSE. Transparent Paper, Ltd., R. K. Morcom, H. Hallam, and D. L. Pellatt. June 2, 1931. 380,053.

CRACKING HYDROCARBON OIL. A. L. Mond (*Universal Oil Products Co.*). June 2, 1931. 380,069.

PRODUCTION OF DISINFECTANTS. A. L. Mond (*Kali-Chemie Akt.-Ges.*) June 4, 1931. 380,077.

METHOD AND APPARATUS FOR THE PRODUCTION OF NITROGEN AND HYDROGEN BY THE THERMAL DECOMPOSITION OF AMMONIA. C. S. Hall and Imperial Chemical Industries, Ltd. June 4, 1931. 380,110.

PREPARATION OF DYESTUFFS OF THE ANTHRAQUINONE SERIES. G. B. Ellis (*Chemical Works vorm. Sandoz*). June 5, 1931. 380,078.

MANUFACTURE AND USE OF AZO-DYESTUFFS. British Celanese, Ltd., and G. H. Ellis. June 6, 1931. 380,061.

PROCESS FOR THE MANUFACTURE OF ANTHRAQUINONE DERIVATIVES. A. Carpmael (*I. G. Farbenindustrie*). June 6, 1931. 380,062.

ALUMINIUM ALLOYS WITH HIGH RESISTANCE TO THE ACTION OF ALKALINE, ESPECIALLY SODIUM CARBONATE SOLUTIONS. I. G. Farbenindustrie. June 16, 1930. 380,152.

PRODUCTION OF RICH GAS FROM BITUMINOUS FUELS AND DISTILLATION RESIDUES BY GASIFICATION WITH OXYGEN UNDER ELEVATED PRESSURE. Metallges A.-G. July 5, 1930. 380,158.

APPARATUS FOR THE SEPARATON OF HYDROCARBONS FROM GASES CONTAINING THE SAME TOGETHER WITH HYDROGEN. J. Y. Johnson (*I. G. Farbenindustrie*). June 20, 1931. 380,164.

PRODUCTION OF SOAPS. Dr. C. Cronquist. Aug. 21, 1931. 380,232.

MANUFACTURE AND PRODUCTION OF ELECTRODES FOR ELECTRIC STORAGE BATTERIES. J. Y. Johnson (*I. G. Farbenindustrie*). Aug. 29, 1931. 380,242.

MANUFACTURE OF SULPHONATED CONDENSATION PRODUCTS. Compagnie Nationale de Matières Colorantes et Manufactures de Produits Chimiques du Nord Reunies Etablissements Kuhlmann. June 30, 1931. 380,252.

PROCESS FOR WEIGHTING NATURAL SILK AND PRODUCTS CONTAINING NATURAL SILK. Dr. R. Clavel. Jan. 29, 1931. 380,269.

PROCESS AND APPARATUS FOR PURIFYING AND SOFTENING WATER. A. J. A. Lacroix. Jan. 14, 1931. 380,333.

PROCESS AND APPARATUS FOR THE FINAL REFINING OF BENZOLES WASHED WITH ACID. Socfl des Etablissements Barbet. Feb. 5, 1931. 380,348.

PROCESS AND APPARATUS FOR MAKING ARTIFICIAL SKINS OR FILMS, MORE PARTICULARLY FROM SOLUTIONS OF CELLULOSE IN SCHWEITZER'S REAGENT. J. P. Bemberg A.-G. Feb. 19, 1931. 380,356.

PRODUCTION OF NAPHTHENATES OF ALUMINIUM OF THE RARE EARTH METALS, AND THE ACID EARTH METALS. I. G. Farbenindustrie. March 2, 1931. 380,360.

MANUFACTURE OF LIGHT SENSITIVE MATERIALS. Kodak, Ltd. March 12, 1930. 380,140.

PRODUCTION OF STABLE EMULSIONS. Erba Fabrik Chemischer Produkte Spezialitaten für Die Textilindustrie. Sept. 17, 1930. 380,065.

PROCESS FOR PROTECTING MAGNESIUM AND ALLOYS THEREOF AGAINST THE ACTION OF POLYHYDRIC ALCOHOLS OR MIXTURES OF SAME WITH WATER. I. G. Farbenindustrie. Aug. 6, 1931. 380,427.

PRODUCTION OF HIGHLY SOLUBLE BASIC SLAG. A. Süllwald. May 7. 1931. 380,143.

Complete Specifications open to Public Inspection

HYDROGENATION OF CARBONACEOUS MATERIALS. F. Uhde. Sept. 8. 1931. 24725/32.

1-PHENYL-3-METHYL-4-ALKYL-AND-4-ARALKYL-PYRAZOLONES AND PROCESS FOR THE MANUFACTURE OF SAME. F. Hoffmann-La Roche and Co., A.-G. Sept. 7, 1931. 24815/32.

PROCESS OF SENSITISING SILVER HALIDE EMULSION LAYERS. I. G. Farbenindustrie. Sept. 9, 1931. 25197/32.

MANUFACTURE OF AZO-DYESTUFFS. I. G. Farbenindustrie. Sept. 10, 1931. 25201/32.

MANUFACTURE OF DYESTUFFS OF THE TRIARYLMETHANE SERIES. I. G. Farbenindustrie. Sept. 12. 1931. 25355/32.

Applications for Patents

PREPARATION OF IRON CYANOGEN COMPOUNDS. M. I. Aische. Sept. 16. 25743.

CONCENTRATION OF NITRIC ACID. Appareils et Evaporateurs Kestner. Sept. 16. (Germany, Sept. 18, '31.) 25846.

IMPROVING OILY AND FATTY VEGETABLE PRODUCTS CONTAINING HEAT-COAGULABLE ALBUMINS. L. Berczeller. Sept. 15. 25721.

MANUFACTURE OF CRYSTALLINE MENTHOL. J. W. Blagden. Howards and Sons, Ltd., and W. E. Huggett. Sept. 16. 25810.

EMULSIFYING APPARATUS. C. J. Coleman. Sept. 14. 25602

FORMING EMULSIONS. C. J. Coleman. Sept. 14. 25603

EXTRACTION OF METALS FROM ORES. H. E. Coley. Sept. 12. 25399.

MANUFACTURE OF CONCENTRATED NITRIC ACID. E. I. Du Pont de Nemours and Co., and S. L. Handforth. Sept. 15. 25678.

MANUFACTURE OF AZO DYES. E. I. Du Pont de Nemours and Co. Sept. 15. (United States, Sept. 19, '31.) 25679.

PROVIDING ACTIVATED CARBON FROM CARBONACEOUS MATERIALS. R. W. Easton. Sept. 12. 25342.

1-PHENYL-2-3-DIMETHYL-4-ALKYL-5-PYRAZOLONES, ETC. F. Hoffmann-La Roche and Co. Akt.-Ges. Sept. 12. (Germany, Oct. 9, '31.) 25352.

DYEING CELLULOSE ETHERS, ETC. J. Y. Johnson (*I. G. Farbenindustrie*). Sept. 15. 25669.

MANUFACTURE OF SULPHONATION PRODUCTS. J. Y. Johnson (*I. G. Farbenindustrie*). Sept. 17. 25921.

TREATMENT OF FILMS, ETC., OF CELLULOSE ESTERS. I. G. Farbenindustrie. Sept. 12. (Germany, Oct. 5, '31.) 25351.

MANUFACTURE OF DYESTUFFS. I. G. Farbenindustrie. Sept. 12. (Germany, Sept. 12, '31.) 25355.

PROTECTING WOOL, FUR, HAIR, FEATHERS, ETC., AGAINST ATTACK BY MOTHS. I. G. Farbenindustrie. Sept. 15. (Germany, Sept. 16, '31.) 25722.

MANUFACTURE AND APPLICATION OF ACCELERATORS FOR VULCANISATION. I. G. Farbenindustrie. Sept. 16. (Germany, Sept. 19, '31.) 25818.

MANUFACTURE AND APPLICATION OF ACCELERATORS FOR VULCANISATION. I. G. Farbenindustrie. Sept. 16. (Germany, Sept. 19, '31.) 25819.

UTILISATION OF SOLID CARBON DIOXIDE AS REFRIGERANT. Imperial Chemical Industries,, Ltd., and F. Heywood. Sept. 13. 25477.

MANUFACTURE OF PROPELLANT EXPLOSIVES. Imperial Chemical Industries, Ltd. Sept. 14. 25589.

MOULDABLE COMPOSITIONS, AND ARTICLES THEREFROM. Imperial Chemical Industries, Ltd. Sept. 15. 25675.

COATING COMPOSITIONS. Imperial Chemical Industries, Ltd. Sept. 15. 25676.

MANUFACTURE OF CELLULOSE ACETATE. Kodak, Ltd. Sept. 15. (United States, Sept. 16, '31.) 25697.

PRODUCTION OF SULPHURIC ACID. A. L. Mond (*Metallges, Akt.-Ges.*) Sept. 13. 25453.

PROCESS FOR SIMULTANEOUS PRODUCTION FROM METHANE OF HYDROGEN, LAMP BLACK, ETC. C. Padovani. Sept. 12. (Belgium, Sept. 19, '31.) 25344.

WATER SOFTENING APPARATUS. Permutit Co. United Water Softeners, Ltd. Sept. 15. 25734, 25735.

Chemical Trade Inquiries

Abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

Canada.—A firm of grocers' brokers in Montreal desire to obtain United Kingdom agencies for the sale of edible oils, on a commission or consignment basis. They cover the Province of Quebec and Eastern Ontario, but do not sell in the main trading centre of the latter. (**Ref. No. 393.**)

Straits Settlements.—H.M. Trade Commissioner at Singapore reports that the Singapore Municipality is calling for tenders, to be presented in London or Singapore by November 7, 1932, for the supply of malleable iron fittings and miscellaneous special fittings required by the Water Department during the year ended December 31, 1933. (Ref. G.X. 11865.)

Straits Settlements.—H.M. Trade Commissioner at Singapore reports that the Singapore Municipality is calling for tenders to be presented in London or Singapore by November 7, 1932, for the supply of galvanised wrought-iron unsocketed tubes (steam quality) of nominal bores ½ in. to 2½ in., which may be required by the Water Department during the year ending December 31, 1933. **(Ref. G.X. 11866.)**

From Week to Week

The Directors of the British Aluminium Co. have decided to await the full year's trading results before consideration of the payment of a dividend on the ordinary shares.

M. Jean Monet, former Assistant Secretary-General of the League of Nations, has been appointed a member of the Liquidation Committee of the Kreuger and Toll Co., to watch specially the interests of foreign creditors. The other four members of the Committee are Swedes.

Professor F. M. Rowe, D.Sc., F.I.C., head of the colour chemistry and dyeing department at Leeds University, has been admitted to the livery of the Worshipful Company of Dyers and to the freedom of the City of London. Professor Rowe has on three occasions been awarded the company's gold research medal for original work in the science of dyeing.

Representatives of municipal authorities, prominent members of the gas and electrical industries, and technical experts on solid fuel attended the opening of the annual conference of the National Smoke Abatement Society in Newcastle, on September 23. Dr. H. A. Des Voeux, the president of the society, is sharing the work of presiding over the various sessions with Sir Thomas Oliver and Dr. J. T. Dunn, the well-known public analyst.

The Shell Oil Company of Canada has begun work on the erection of a new oil refinery at Montreal, representing a capital investment of $2,000,000. Employment will be afforded in the early stages of construction to about 300 men. The refinery is to have an initial capacity of 100,000 gallons of gasoline per day in addition to other products. Plant construction will include five tanks each of 4,130,000 gallons capacity, believed to be larger than any tanks yet built in Canada.

The fifth plenary meeting of the International Conference of Benzole Producers was held at Brussels, on Tuesday, September 20, following the meeting of the technical committee, which took place on Monday. Delegates came from Belgium, Czechoslovakia, France, Germany, Great Britain, the Netherlands, Poland, the Sarre territory, and Spain, but not from Italy. Sir David Milne-Watson, president of the National Benzole Association, was elected president, to succeed M. H. Laurain, president of the French Association of Benzole Producers, and the president-founder of the International Conference.

One result of the Ottawa Conference is the arrival in this country of M. Cyrille Vaillancourt, head of the Quebec Maple Sugar Industry Service. He has been sent by the Quebec Government to make Canadian maple sugar, its virtues and its uses, better known in Great Britain. Maple sugar, which has a distinctive and rather fascinating flavour, is first drawn from the maple tree in the form of a watery syrup. This is evaporated down until its density is 13 lb. 2 oz. to the gallon. In Quebec the industry is under Government control, and all the processes of preparation are conducted under the most hygienic conditions. The final product takes several forms—syrup, granulated sugar, solid sugar "bricks" for eating as a sweetmeat, and "maple butter."

The chief difficulty confronting Mr. Medley Whelpley, the president of the Cosach Nitrate Combine, regarding the activities of independent companies, has now been eliminated, in the opinion of Don Enrique Zanartu, who was Finance Minister in the Davila Administration. He states that Mr. Whelpley has received a convincing demonstration of the Government's power to fulfil its contracts, and sufficient proof also that the nitrate produced by such companies could not injure the world market, since all sales must be approved by the Government. Don Enrique added that he was astonished at the continuance of the negotiations with nitrate interests, seeing that the present provisional Government would be changed in seventy-five days' time.

The British Commercial Gas Association will celebrate its coming-of-age next week, when its 21st annual conference is held in Leeds from September 26 to 28. The president of the conference is Councillor Geoffrey A. Kitson, chairman of the City of Leeds Gas Department. Special attention will be given to the development of the industrial load. Papers are being presented by Mr. A. W. Smith, general manager and secretary, Birmingham Gas Department), Col. W. M. Carr, engineer, general manager and clerk, Stretford Gas Board, and Mr. C. S. Shapley, general manager, Leeds Gas Department. The Association is to be honoured with the presence of Prince George at the banquet to be held at Leeds Town Hall on Tuesday. Prince George, like other members of the Royal Family, takes a keen interest in industrial affairs, and his attendance at the Association's banquet will not be the first occasion on which the gas industry has been honoured by a visit from Royalty. The Duke and Duchess of York attended the annual conference of the British Commercial Gas Association at Eastbourne in 1929. The Prince of Wales, too, earlier this year opened a £1,000,000 coke oven plant at the Beckton works of The Gas Light and Coke Company—works which were honoured by a visit from the King and Queen in 1926 on the occasion of the opening of new coal conveying plant.

Recent wills include:—Lord Ebury, of Gore Lodge, Lubenham, Leicestershire, a director of the Union Bank of Australia, Ltd., who started his career as a metallurgical chemist, £39,603.

The Council of the Institute of Chemistry has forwarded a contribution of £250 to the library of the Chemical Society. It is understood that the privileges regarding the use of the library by Fellows, Associates and Registered Students of the Institute will be continued.

A serious fire broke out on September 17 at the factory of the Western Oxide and Paint Co., Ltd., Cornwall. This factory was recently considerably altered and enlarged, and the work of manufacturing zinc oxide for paint making was being carried on day and night. The flames were fed by barrels of oil and sacks, and in a very short time the roofs of the buildings collapsed and the walls fell in. The fire lasted for more than five hours, and the loss is put at a large figure.

Manchester Corporation Gas Department is engaged in research with the object of producing spirit from by-products of the gas undertaking which can be used as spirit for motor traction. Experiments have been going on for some time with tar by-products, and these have resulted in the discovery of a fuel which in many respects resembles benzol. The fuel is considerably cheaper than petrol, and if the defects so far revealed are overcome it is believed that the department will save hundreds of thousands of pounds annually for the city, and be able to supply all fuel for the Corporation 'buses.

Obituary

Mr. T. Clarkson, the English manager of the Bagdad branch of Imperial Chemical Industries, has died of plague at Bagdad.

Forthcoming Events

Sept. 28.—Electroplaters' and Depositors' Technical Society. Reunion at Lyons' Angel Café, Islington, London. Open discussion on "The Possibilities of Standardising Electrodeposits." 8.15 p.m.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

[NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

BARROW HAEMATITE STEEL CO., LTD. (M., 24/9/32.) Registered August 29, confirmatory mortgage to District Bank, Ltd., securing £150,000 and all moneys due or to become due to the Bank; charged on properties comprised in mortgage and sub-mortgage of April 22, 1924, and notes to the nominal amount of £165,000. *£1,248,590. June 24, 1931.

CEMENT INDUSTRIES, LTD., London, S.W. (M., 24/9/32.) Registered September 9, £4,800 debs., part of £70,000; general charge.

LOVERING CHINA CLAYS, LTD., London, E.C. (M., 24/9/32.) Registered September 7, Trust Deed dated Sept. 1, 1932, supplemental to Trust Deed dated June 7, 1929, securing £250,000 debs., and 1 per cent. premium, etc.; charged on one half of co.'s net profits in any year up to end of March 31, 1935, if such profits do not exceed £10,000 and if they exceed £10,000 all such profits less £5,000. After March 31, 1935, all net profits of company. *£259,800. Aug. 9, 1932.

MALLINSONS CHEMICALS, LTD., Huddersfield. (M., 24/9/32.) Registered Sept. 7, £500 debs. to C. Cooper, Langdale Park Road, Lockwood, and another; general charge. *Nil. Mar. 31, 1931.

MURPHY AND SON, LTD. (late Murphy and Lonsdale, Ltd., and Vanguard Chemical Co., Ltd.), Wheathampstead. (M., 24/9/32.) Registered Sept. 2, £5,000 and £10,000 mortgages to A. J. Murphy, Wheathampstead House, Wheathampstead; charged on properties at Wheathampstead. *Nil. Oct. 26, 1931.

TARFROID (1931), LTD., London, E.C., road material manufacturers. (M., 24/9/32.) Registered Sept. 7, £2,000 deb., to Oceana Development Co., Ltd., 3 London Wall Buildings, E.C.; general charge.

Company News

Alexander Duckham & Co.—An interim dividend of 4 per cent. less tax, has been declared. At the same period last year only 3 per cent. was paid.

Dartmoor China Clay Co.—For the year 1931 a profit of £2,330 is reported. After adding the amount brought forward and deducting tax and amount written off loose plant and tools, there is a balance remaining of £5,310 to be carried forward.

Cooper, McDougall & Robertson.—The directors have intimated that, in view of the continued disturbed state of international finance and general trading conditions, they have decided not to pay an interim dividend on the ordinary shares.

Indestructible Paint Co., Ltd.—In an interim report, the directors say that they are satisfied that profits during the six months to June 30 last fully justify the payment of the usual 5 per cent. interim on the ordinary shares, which will be paid, less tax, on October 1.

Taylors Drug Co.—The half year's dividend is announced on the 6 per cent. cumulative preference and 7 per cent. "A" cumulative preference shares, for the six months ending September 30.

International Nickel Co. of Canada.—A quarterly dividend is announced at the rate of 7 per cent. per annum on par value of preferred stock, payable on November 1.

Sheepbridge Coal & Iron Co., Ltd.—The gross profit for the year to June 30 last was £140,125 against £134,416, and the net balance £82,691, compared with £74,344. The ordinary shares receive a dividend of 5 per cent., a further £20,000 is placed to reserve, and £83,025, against £87,260, is carried forward.

Staveley Coal & Iron Co., Ltd.—For the year to June 30 last, there was a profit, after providing for management expenses and taxation, of £372,292, against £432,074 in the previous twelve months. The ordinary shares receive 5 per cent., tax free, against 6 per cent., tax free, and £50,000, compared with £75,000, is added to reserve, leaving the carry-forward practically unchanged at £107,155.